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A HISTORY OF FIJI

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Part I

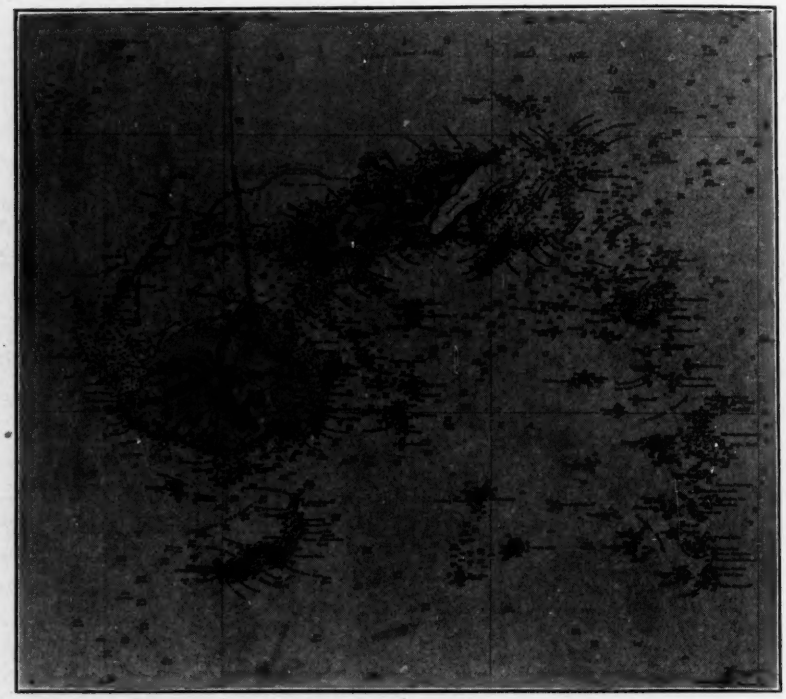
OF all the island groups in the outer Pacific none surpass the Fijis in their rare combination of beautiful scenery and interesting natives. The islands are upon the opposite side of the world from England, for the meridian of 180° passes through the centre of the group crossing the island of Taviuni. The islands lie from 15° 30′ to 19° 30′ south of the equator, and are thus south of the region of perpetual trade winds, but still well within the tropics, the center of the group being about 1,000 miles due north from New Zealand.

That dauntless old rover, Abel Jansen Tasman, discovered them in 1643 on his way from Tonga in the *Heemskirk* and *Zeehaan* and named them "Prince William's Islands" and "Heemskirk's Shoals." After this, they were all but forgotten until July 2, 1774, when Captain James Cook sighted the small island of Vatoa in the extreme southeastern end of the group. The natives fled into the forest upon the approach of his boat, and he contented himself by leaving a knife, some medals and nails in a conspicuous place. Finding many sea-turtles in the region, he named his land-fall "Turtle Island," and then departed from the Fijis never to return.

In May, 1789, Captain Bligh sailed through the group in the small open boat in which he made the voyage of 3,600 miles from Tonga to Timor, this feat being celebrated in Byrons's poem "The Island." He was pursued by two canoes from Waya Island, and dared not land nor hold any communication with the natives. Later in 1792, Bligh again sailed among the Fijis, this time while in command of the man-of-war *Providence*, and in 1796 Captain Wilson cruised among the islands upon his missionary voyage in the *Duff*. Thus gradually the group became known to Europeans; but remained uncharted until 1840, when the United States Exploring Expedition, under Wilkes, made a survey of the region. Indeed,

the oldest detailed accounts of the islands and their inhabitants is that given by Wilkes in the third volume of his narrative of the expediton.

Counting isolated rocks, the archipelago is composed of about 270 islands having a total area of 7,400 square miles, or nearly the same as that of Massachusetts. Two of the islands are far larger than the others, Vanua Levu (the great land) being about 100 miles long and 25



miles wide, and Viti Levu (Great Viti) being 80 miles long and 55 wide. Kandavu and Taviuni have not one twentieth the land area of the two larger islands, and all the others are much smaller, so small indeed that only about 80 islands of the group are large enough to be inhabited.

Geologically speaking, the Fijis are old and the volcanoes which gave rise to them have long ago subsided into their final rest. Yet even to-day there are reminders of more active times in an occasional earthquake, or the hot springs of Ngau or of Savu Savu valley and other places on Vanua Levu, or the pumice, which at times rises to the surface of the sea and is cast ashore at Kandavu. The islands were once much larger and higher than they are to-day, for tropical rains have washed the soft lavas into the surrounding sea, leaving here and there pinnacles of hard basalt towering upward in fantastic castellated forms and imparting a romantic beauty to the view which is surpassed only

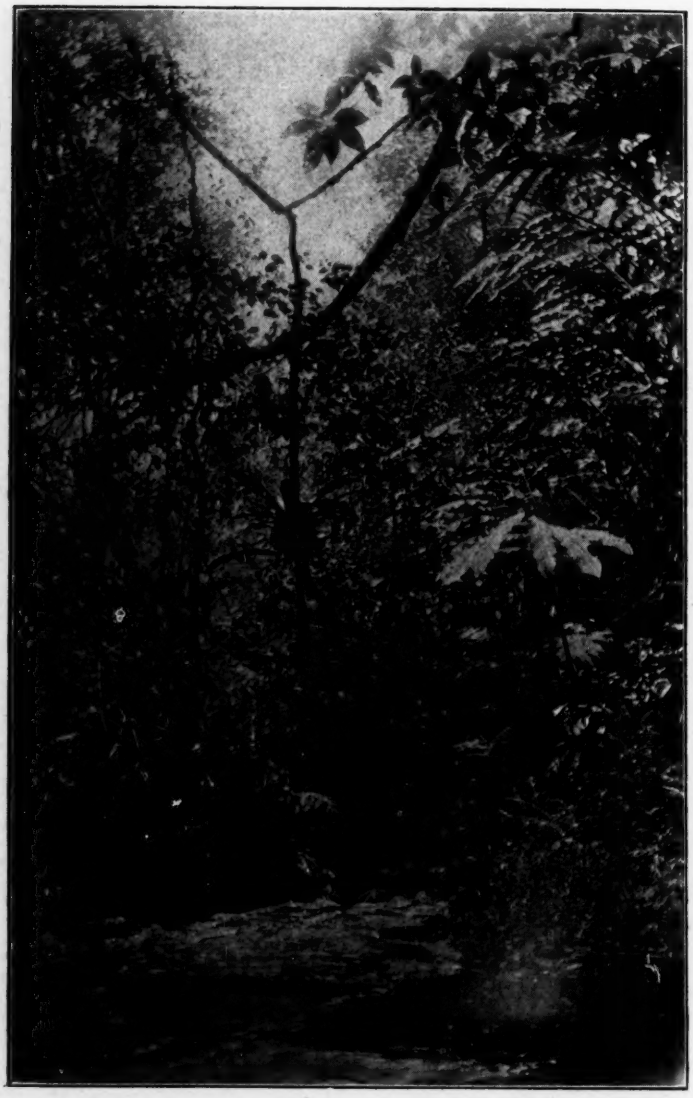
in the Society and Marquesas Islands. The little island of Kobu near Nairai is a mass of volcanic rock, 90 feet in height, and is so strongly magnetic that a compass placed upon its summit is deflected 85°.

In the Fijis the erosion has gone so far that most of the old volcanic rims have disappeared. Totoya and Thombia are, however, beautiful cup-like craters, their centers now being harbors encircled by crescent-shaped ridges, and there are a few fairly well-defined craters among the mountains of the larger islands. Indeed, at Kambara a small volcano has in recent, but still prehistoric, times broken through the elevated coral reef, but no native myths speak of volcanic eruptions.

The Fijis are much older than the large islands of the Hawaiian group or than some of the Samoan and Tongan islands, the volcanoes of which are still active. Indeed, in the interior of Viti Levu plutonic rocks and slates are found attesting to the considerable age of this island, allying it to such land masses as New Zealand or New Caledonia, which are partly volcanic and partly continental in character. Thus the Fijis differ from the simple volcanic tumuli which constitute the Hawaiian, Samoan, Society and Marquesas islands. In Hawaii and Tahiti we find great central volcanic peaks, from the summits of which deep valleys radiate outward to the sea, but in Fiji the large islands have been formed by fusions between many adjacent volcanic cones, and in later times the erosion has gone so far and local elevations and depressions have been so frequent that the landscape is broken and wholly irregular.

Indeed, the islands have not been passive during all the ages in which the rains have worn them down, for there have been depressions, and also great upheavals here and there, as at Vanua Mbalavu, where the old coral reef is now a bold precipice of overhanging castellated crags towering far above the waves that dash at its feet. This old coral rock is cavernated and, at least one place along the shore, at Black Swan Point, on Vanua Mblavu Island, one may enter through a small cleft in the precipice and find oneself in a spacious chamber several hundred feet in height, with veil-like sheets of stalactites sparkling in the dim light that wanders inward through some hidden rift far up in the vaulted roof. A deep pool of wonderfully clear ocean water lies within this shadowy retreat, and brilliant blue and green fish flit butterfly-like through their natural aquarium, the floor of which is carpeted by graceful sea-whips, and slowly creeping crinoids with long feathery arms.

Many other islands also exhibit elevated coral reefs, which in some cases, as at Vatu Vara, have been lifted nearly 1,000 feet above the sea, and, near Suva, the hillside is full of fossil sea-shells and corals. We can see that the islands were once much larger than they are to-day, for nearly every one is encircled by a coral reef several miles out to sea, which marks the contour of the old coast line. Indeed, at Astrolabe



A Ravine in Fiji, Viti Levu Island.

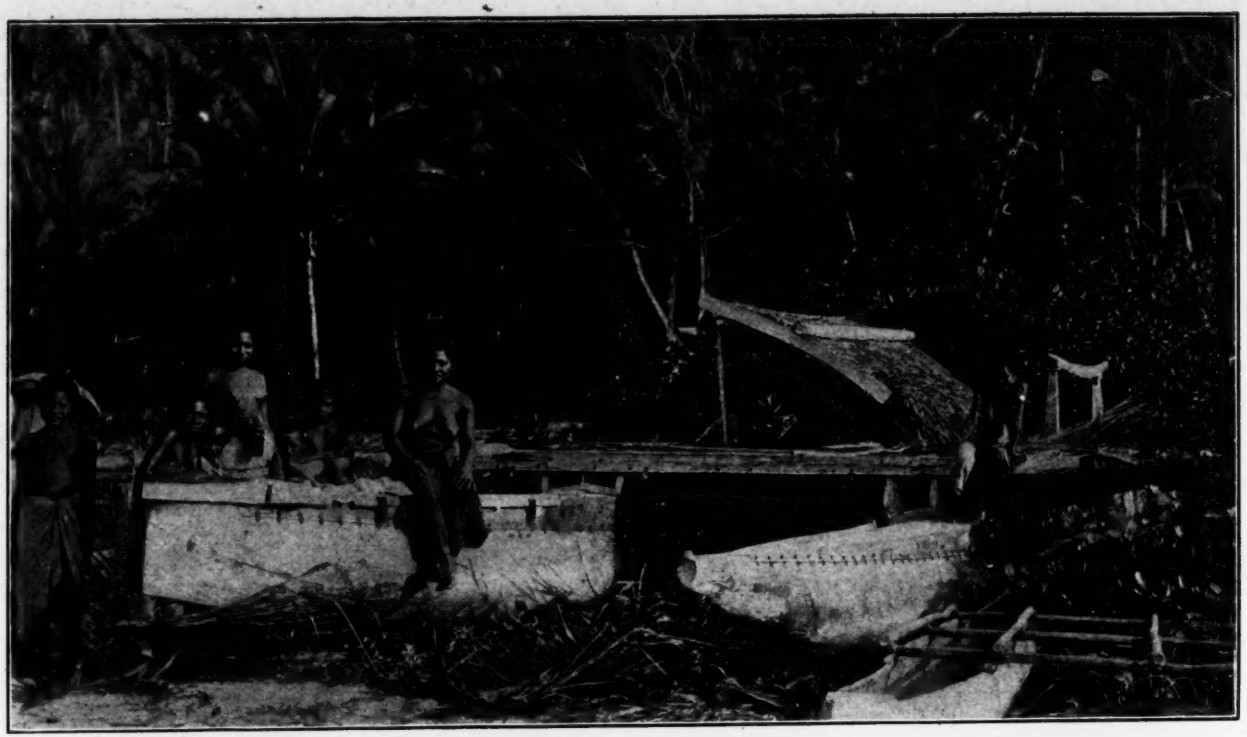
Reef, we find a small cavernated volcanic rock, the last remnant of an island, surrounded by a broad lagoon which is edged on its seaward side by a rim of coral reef over which the surf breaks ceaselessly. In other cases, as at Cakau-momo, the island has washed away and only the submerged reef is left to mark its former site.

The very land has age and life and is vanishing before our eyes. In the past the islands were higher, but now the loftiest mountain peaks are not over 4,600 feet.

The earthquake waves, which must have accompanied many of the changes of elevation, may have given rise to the myth of a deluge, which under varied forms is found almost universally among the natives of the tropical Pacific, but we need not resort to such remote or hypothetical occasions for the establishment of the flood-myths, for almost every year between February and March there is a severe storm in Fiji, and recent floods of the Rewa River are now the topic of native song.

It is to the rich tropical forest which clothes them that the Fijis owe their charm. Even the sheltered relatively dry leeward slopes of the mountains are fairly well covered with forest, but on the sides which face the southeast trade wind the vegetation crowds into every nook and cranny of the precipices even to the summits of the highest peaks. So copious is the rainfall that the Rewa River is larger than any in England and is navigable for fifty miles above its mouth, its width being fully three thousand yards, where it meets the ocean.

The beauty of the mountain valleys produces an impression which time can not efface from the memory. Great Tahitian chestnuts, the "Ivi" (*Inocarpus edulis*), with buttressed trunks, tower far above like columns of an ancient temple garlanded in green, while overarching the rock pools of the stream are the rich brown stems of tree-ferns crowned by emerald sprays of nature's lace-work. Broad-leaved caladiums cluster in the water, and the clambering Pandanus winds in reptilian folds over the high boughs, where dainty orchids nestle far from the reach of all below. Now and again there is a flash of color, where some cockatoo or parrot or brilliant butterfly appears only to vanish in the leafy maze, or here and there through a break in the canopy a furtive beam of sunlight penetrates to gild the greenness of the shade. One looks in vain for dead trees and old decaying logs for all is life in this luxuriant growth. Death has here no lasting place, for termites and ants and a host of parasitic plants set hungrily upon all that weaken, and the dying trunk shrinks into other greenness and passes phoenix-like into other life. Wilkes spoke truly when he said of the islands, "So beautiful was their aspect that I could scarcely bring my mind to the realizing sense of the well-known fact that they were the abode of a savage, ferocious and treacherous race of cannibals." To-day there are



CANOES AT KAMBARA ISLAND, FIJI.

no cannibals, and one is safer in "dark Fijia" than in the streets of any civilized city.

An extraordinary number of the forest trees of the Fijis furnish food for man. Such are the bread-fruit, which grows to be 50 feet high, with deeply incised glossy leaves, sometimes almost two feet long. The Malay apple, or kavika (*Eugenia*), grows to a great height and bears a delicious fruit, which, when ripe, is white, streaked with delicate pink, and most refreshing and rose-like to the taste. The cocoanut palm clusters in dense groves along the beaches, the long leaves murmuring to the sea breeze as they wave to and fro, casting their grateful shade upon the native village. Of all trees none is more useful to tropical man than the cocoanut. In time of drought it provides a life-sustaining drink, its leaves serve to thatch the sides of houses and its nuts become drinking cups, or provide oil or food; its wood serves for manifold purposes; its terminal bud is the celery of the tropical epicurean, and the sap from its flower-stalk provides an intoxicating beverage. Indeed, to do justice to its uses would lead us so far afield that we must perforce desist. Curiously, the cocoanut thrives only on the lowlands near the ocean, and flourishes best where the sea-spray settles upon its leaves, or even where its roots sink beneath the level of the salt water. Very rarely one sees a cocoanut palm growing upon the mountain side at Tahiti, up to 800 feet above the sea, but this is exceptional. Bananas and the wild plantain (Fei) grow luxuriantly in the forest, as do also oranges, lemons, limes, shaddocks, guavas, alligator pears, the papaw, mango and many other smaller shrubs and vegetables. Indeed, from remote times the natives have cultivated the soil, and their principal farinaceous food to-day consists in the yam (*Dioscorea*), which becomes from four to eight feet in length, and in the dalo, a caladium, which grows in swampy places. In time of harvest they often bury the breadfruit, dalo or bananas in pits lined thickly with leaves and covered with earth and with stones to foil the pigs. Treated thus, the fruit ferments and may remain for months before being cooked and eaten. Famine is indeed all but impossible in the high islands of the tropical Pacific.

In the rich soil of the broad Rewa valley sugar-cane is cultivated extensively. Cotton becomes a perennial tree in Fiji and produces an exceptionally good quality of boll. Delicious pineapples grow on the less fertile soils, and coffee thrives on the mountain slopes. Indeed, had the Fijis but a market for their produce, they would outstrip Hawaii as centers of agricultural industry.

Even in savage days the natives delighted to cultivate flowers, and the chiefs wore garlands of blossoms around their heads as do the young men and maidens of to-day. It was by means of the flowers that they

knew the months, for the scarlet blooms of *Erythrina* marked the season for the planting of crops. June was heralded by the "tombebe" flowers along the shore, and when the ivi with its violet-scented flowers bloomed in the forest, the natives watched, knowing that it was nearing November when upon the morning of the moon's last quarter the water over the reef would be crowded by myriads of the Mbalolo worms swimming only to burst and shrivel with the rising of the sun, thus casting forth their eggs into the sea, after which the worms, emptied of eggs, sink as mere translucent skins to die upon the bottom. This was the great feast of the Mbalolo, the New Year's Day of former times, when bearers would be despatched to carry the cooked worms nicely wrapped in leaves to far-off chiefs among the mountain valleys.

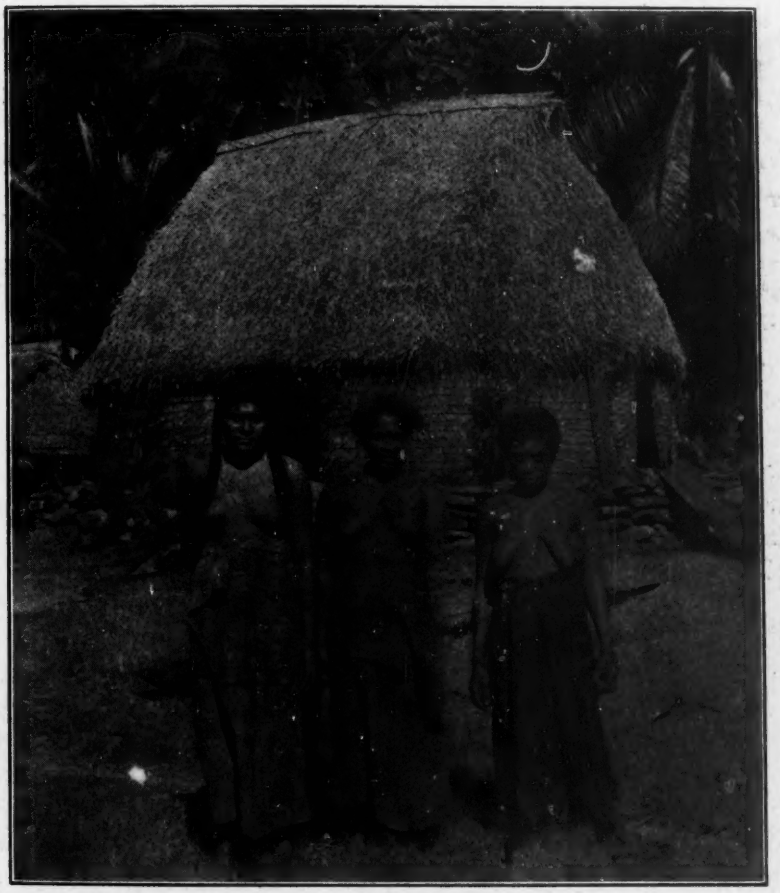
A Maiden of Kambara, Fiji. Type of the Viti-Tonga race.

Once from an old man I gathered a myth of the Mbalolo to the effect that long ago their ancestors were sailing over the sea, while one of the sea-gods guarded the canoe and each day sent food in the form of the Mbalolo, but one old man, fearing it might not be continued, collected more than was required for the day and hid it beneath a mat. Whereupon the god visited the canoe and detected the Mbalolo through the odor arising from its decomposition. In a rage, he swore never again to provide food for the ingrates; but the old man taunted him, saying that the real reason was he had lost the power to cause the worms to appear. Thus, in order to show that he still had power to produce it, the Mbalolo is permitted to swarm only upon the mornings of the last day of the October, and especially of the November moon. Accordingly, October is called *Vula i Mbalolo leilei* (the moon of the little Mbalolo) and November *Vula I Mbalolo levu* (the moon of the Great Mbalolo). In Samoa, this worm is called Palolo from *Pa,* to burst,

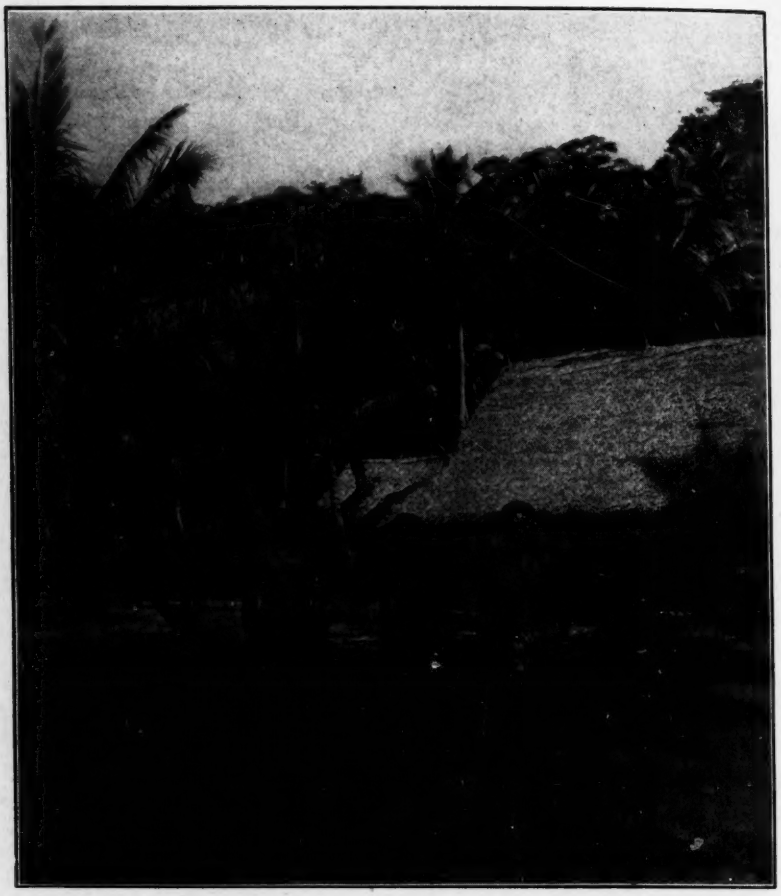
and *lolo,* oily, referring to the oily appearance of the water when myriads of the worms burst and cast forth their eggs.

I suspect this myth to be of recent origin, for it bears a suspiciously close resemblance to the manna story in the Bible. Moreover, the old Fijian mythology asserts that their original ancestors were created in Fiji and did not sail over the ocean to these islands. It is remarkable how quickly a new myth may arise among a simple people. Certain floods which occurred within the century have passed into mythology, and one of the mountain tribes has a song of the marvellous manner in which sugar is made at the recently established sugar mill on the Rewa river. A tower of Babel myth has arisen since the conversion to Christianity, and, in Tahiti, a recently originated folk story tells of the creation of the first woman *Ivi* from a bone of the first man.

The Fijians are of mixed stock. Their dark brown skin, thick



WOMEN OF FIJI. The long uncut locks indicate that a woman is unmarried.



NATIVES OF KAMBARA ISLAND, FIJI.

mop-like heads of hair, broad noses, and full lips betoken Papuan ancestry of remote African origin, and probably the earliest inhabitants were of purer Negroid blood than those of the present, for there has been a constant admixture with the Polynesians, who, being good navigators, have peopled the remote islands of the outer Pacific. For ages this admixure has been checked through the practice of the Fijians of killing and eating strangers who were stranded upon their shores, and it is interesting to see that it is only in the small islands of the Lau group of the Fiji archipelago that a decided mingling of the Papuan and Polynesian elements is observed. These Lau islands are set one after another, like the leeward isles of the West Indies, in a long sweeping crescent along the eastern edge of the archipelago, and are only about 270 miles west of Tonga, hence the Tongans, under their great chief Maafu, overran them, killing the men and capturing the women,

and producing a tall, fine-featured, brown-skinned "Vititonga" race, far superior to the negroid peoples of the western islands of the Fijis.

In Fiji, as elsewhere in the Pacific, the strongest natives live along the shore where coral reefs and cocoanuts afford abundant and varied food. At times these shore tribes welcomed the coming of Tongans among them, for they are far better navigators and more intelligent than the Papuans of ancient Fiji, and they taught the art of canoe building. Indeed, pigs and chickens and certain vegetables are thought to have been introduced by this back wave of Polynesian immigration from Tonga.

Among the mountain valleys of Viti Levu one may still see traces of the stunted, sooty-skinned, long-armed, mop-headed negroid race of old Fiji, while in the eastern parts of the group and along the fertile coasts the natives are superior both mentally and physically. The average height of the chiefs is fully six feet, they stand superbly erect, no student's stoop disfiguring the proud shoulders of these noblemen of nature's making. The skin is rich bronze-brown, the lips full, but not protrusive, the nose not especially flattened, and the hair alone remains African and grows into a huge stiff mop which they periodically cover with lime, causing it to lose its black color and to assume a tawny brown-red hue. The eye lacks the languid softness of the Polynesian's and is small, swine-like and often bloodshot, imparting a cruel aspect to the visage.

Yet, withal, the native grace and unconscious dignity of these superb people, especially those of chieftain's rank, produces a profound impression. Physically they seem to be a finer race than we, yet they lack the endurance of the Caucasian, and soon succumb to prolonged exertion, or fall a ready victim to disease. Thus the measles in 1875 assumed the character of a veritable plague, more than one quarter of the population perishing, while in many villages the children starved, and the dead were devoured by hogs, for none were left to bury them.

Yet we must come to the tropical Pacific to see how beautiful the human form may be. As Wilkes wrote, "I have scarcely seen a finer looking set of men than composed the suite of Tanoa" (King of Fiji); and Miss Gordon Cumming spoke truly when she said that no English duchess bore herself with greater dignity and graciousness of mien than did the ladies of the royal family of Mbau.

In many another trait do they show their kinship to the universal feminine. Wilkes attempted to entertain the Queen of Rewa and her maids of honor on the *Vincennes,* but nothing seemed to please, and the party was evidently drifting into failure until, upon a whispered word from the Queen, all became animated and lively expressions of delight changed the entire tone of the afternoon. It transpired later that the Queen had commanded her suite to "act as if pleased."

MBAU, FIJI, from the hill above the town, 1899.

Their scantiness of attire serves but to reveal the beauty of their forms. Indeed, we must recall the fact that even in cannibal days the Fijians would never expose the entire body, for such immodesty would have merited death at the hands of the chief, and in 1827 the natives of Levuka sent off a deputation to protest to Captain Dumont d'Urville against the indecency of his sailors in entering the ocean stripped of clothing. Dress has little or nothing to do with morality; indeed, among savage people the more clothing they are forced to assume the lower do their morals decline. Dressed in his simple waist-cloth, the Fijian is ready at any moment to seek the deep pools of some cool mountain stream in which to bathe. As civilization introduces clothing, so does this practice of swimming decline, and the once cleanly native becomes the prey of filth-diseases. Fortunately, the British Governments of Papua and Fiji have not insisted upon the hat, shirt and trousers for the men, or the ugly "mother hubbards" for the women, which the missionaries have forced upon the natives of nearly all other groups in the Pacific, to the detriment of both health and morals.

As James Chalmers, the great missionary to Papua, wrote in 1885[1]

> Syphilis and strong drink have received the blame for the deterioration and extinction of native races, but I think the introduction of clothing has done much in this direction. To swathe their limbs in European clothing spoils them, deteriorates them, and I fear hurries them to premature death. Put excessive clothing with syphilis and strong drink and I think we shall be nearer the truth. Retain native customs as much as possible—only those which are very objectionable should be forbidden—and leave it to the influence of education to raise them to purer and more civilized customs.

The Polynesians of Samoa, Hawaii, Tahiti and New Zealand had a lyric history sung by priests and sagas which told of days when the ancestors of their chiefs were gods, but the Melanesian race has little of this mythology, and there is no "history" in Fiji, where, according to Wilkes, all are said to have descended from a single pair, whom the gods made black and wicked and to whom they gave but little clothing. Then the gods made the brown-skinned Tongans who behaved better and to whom they gave more clothing, and, last of all, the white men were created, and these were well behaved and were given much clothing. There are apparently no myths of ancient migrations, and the people are said always to have lived in Fiji.

There is no history of the group as a whole, for war was the one chief object of Fiji, and each little district was forever suspicious of its neighbors. Indeed, to such a degree did the Fijians carry their zest for war that two men would walk abreast, never one behind the other, for the temptation of the man behind to club his companion might at any moment become irresistible. It was death to pass behind a chief or to

[1] "James Chalmers, His Autobiography and Letters," pp. 255–256, by Richard Lovett, London, 1902.

cross his shadow, or the shadow of his house. No Fijian revenge was assuaged until the enemy was eaten; indeed, so natural does this seem to them that a high chief asked me in a casual manner whether we of the United States had eaten the Spaniards whom we had killed during the war of 1898.

A detailed account of the ceaseless native wars is given by the Reverend Joseph Waterhouse in "The King and People of Fiji" and by Williams in his fascinating "Fiji and the Fijians," and they are records of treachery, murder, cruelty and vice, unrelieved by the narration of a single fight for principle or an act of mercy or chivalry. In all history there have been few instances of higher courage, fidelity and devotion to their creed than those furnished by the lives of the early missionaries to these islands, and nowhere in the Pacific has conversion accomplished more good and in the process done less harm than in Fiji.

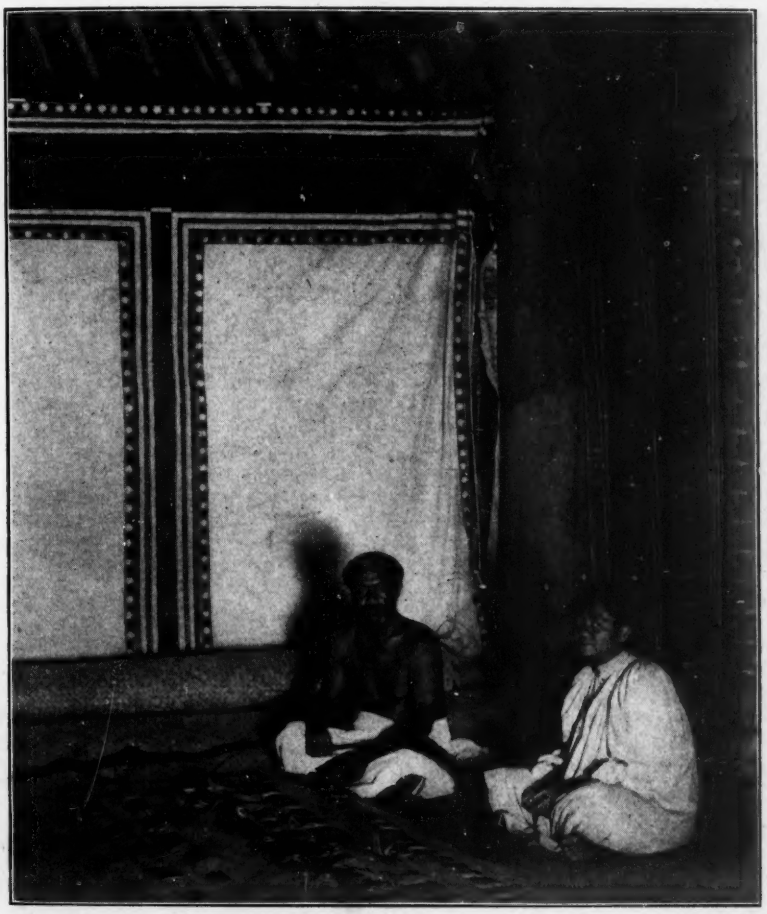
Tradition states that in former times the island of Mbengha was dominant in native affairs, and its chiefs still style themselves "Qali-cuva-ki-lagi," "subject only to heaven"; finally, however, the chief of Rewa conquered Mbengha and slaughtered nearly all its inhabitants, and then, in 1800, the village of Verata on Viti Levu became dominant in Fijian affairs. At this time, Mbanuvi, who had succeeded his father Nailatikau, was the head chief of the town of Mbau, but he soon thereafter died and was succeeded by his son, Na Ulivou (The Hot Stone).

Mbau is a little island, not a mile in width, which lies off the south-eastern corner of the great island of Viti Levu, of which indeed it is a mere outlyer, being connected with the mainland at low tide by a natural causeway. Yet this insignificant islet of a single hill, surrounded by shallow mangrove flats and reefs, was destined to conquer nearly half of Fiji.

In the south seas that chief who first obtained the aid of white men in the use of firearms gained a rapid and terrible ascendency. It so happened that in 1809 the armed brig *Eliza* was wrecked on the coral reef off Nairai, which was a dependency of Mbau, and the natives plundered the vessel. A Swede, named Charley Savage, and three companions made their way to the shore, and Savage was the first white man to come to Mbau. Here it is not improbable that he would have been killed and eaten in accordance with Fijian custom respecting the shipwrecked, had he not bethought himself of a musket which had been left on board, and requested the natives to search for it. They found it, built into the palisade surrounding a native village and soon Na-Ulivou saw in Savage and his musket the means to "world-wide" conquests.

Verata, which was only eight miles from Mbau, was then the strongest power in Fiji, dominating the villages for about ten miles along the shore of Viti Levu, but Mbau, aided by this base imitator of Champlain, soon stripped it of its dependencies, leaving to its chief only his native village. Savage caused the natives to construct an arrow-proof sedan chair, within which he remained comfortably seated firing through an opening, and this contrivance was carried into battle while he terrified and slaughtered the impotent enemies of Mbau. For his share of the spoils of conquest Savage demanded women, and he is said to have acquired a hundred wives. Na-Ulivou heaped honors and titles upon him and gave him for his principal wife a chieftainess of the highest rank, but her children were strangled for reasons of state polity, so that after his death he was survived by but a single daughter.

For two years Mbau enjoyed a monopoly of firearms in Fiji, and



RATU BENI TANOA AND HIS WIFE ADI CAKABAU IN THEIR HOUSE AT NAVUSO, VITI LEVU ISLAND, FIJI, IN 1899. They are cousins, both being members of the Royal Family of Fiji. The screen is a large piece of Taviuni tapa.

conquered all the neighboring islands and overran the eastern and southern coasts of Viti Levu. Finally, in 1813, the Mbauan conquests were pushed as far as Mbua in the southwestern part of Viti Levu, where in a fierce battle the ammunition of Savage and his white companions became exhausted, and they were forced to retreat to a small island in the river, where they were surrounded by thousands of howling enemies engaged in devouring the bodies of the fallen warriors of Mbau. Savage went to the water's edge to treat for terms of surrender, where he was captured, drowned and eaten, and his leg bones made into sail needles, while other parts of his skeleton were ground into powder to be drunk in Yaqona.[2]

In 1814, Na-Ulivou and his warriors again came to Mbua with a great fleet of war-canoes, and wreaked terrible vengeance upon those who had killed their champion Savage. For long years after this no native would pass the spot where Savage died without first plucking some leaves and casting them upon the ground; for, as Williams says

> the Fijian peoples with invisible beings every remarkable spot: the lonely dell, the gloomy cave, the desolate rock, and the deep forest. Many of these he believes are on the alert to do him harm; therefore in passing their territory he throws down a few green leaves to propitiate the demon of the place.

In the South Seas the most dreaded ghost is that of the man who seeks revenge for having been murdered and devoured.

Early in his reign a powerful conspiracy arose against Na-Ulivou, but he drove the rebel chiefs from Mbau and also from Rewa, whither they had retreated, and finally he pursued them to Somo Somo on Taviuni, whence they fled to the distant island of Lakemba, whither he met them in a great sea fight and they were utterly annihilated. After this, Na-Ulivou assumed the title of Vunivalu (root of war), and he reigned the greatest chief in Fiji until his death in 1829.

Rewa, however, remained independent of Mbau, and indeed until the group was annexed to Great Britain these two villages were rivals almost constantly at war.

In about 1804 a number of convicts who had escaped from Australia settled upon Rewa and were protected by its chief, and the aid rendered by these reprobates was sufficient to prevent Mbau from conquering Rewa. Even in Fiji, where cruelty, treachery, cannibalism and ferocity were considered virtues, some of these men are still remembered as monsters of iniquity. In a few years they had nearly all killed one another or fallen in native wars, and only one, Paddy Connel, called Berry by the Fijians, survived until 1841, and served as guide, pilot and interpreter to Wilkes during the surveying operations of the United States Exploring Expedition in 1840. This man became thoroughly Fijianized, having the traditional hundred wives and forty-eight chil-

[2] The "kava" of Samoa.

dren, and so great was his influence that the chief of Rewa would always roast and eat any man who incurred Connel's displeasure. Indeed, if native accounts are to be trusted, Connel was himself a cannibal. All travelers in the Pacific will agree that the most vicious savage is not the native, but the degenerate white who has violated his birthright to civilization.

When Na-Ulivou of Mbau died, he was succeeded by his brother Tanoa (kava bowl), who reigned for twenty-three troubled years, and died a cannibal and a heathen in 1852.

Soon after Tanoa's accession, a powerful faction in Mbau decided to make war upon Rewa. This Tanoa was desirous of preventing, for he was Vasu (nephew) to Rewa, his mother having been a chieftainess of this place. This gave him the right to seize and appropriate to his own use almost anything he desired from Rewa, where he was treated with a respect bordering upon religious adoration; for whenever he visited his mother's district the people would salute him with clapping of hands and shouting "Hail good is the coming hither of our noble lord nephew."

Naturally he was well disposed toward Rewa and he treacherously aided them while ostensibly prosecuting the war. This enraged the Mbau chiefs and they drove him into exile, where he remained five years, but finally in 1837 with the aid of his son Seru (afterwards called Thakombau) he reconquered his native village, and in a fiendish orgy dismembered his captives, roasting and eating their tongues, arms and legs while they still lived.

Beneath every post of his house in Mbau a slave was buried when his new canoes were launched they were rolled into the water over the bodies of living victims who, after being crushed, were roasted and eaten, and when the canoe took to the water men were slain upon its deck so that it might be baptized in blood. When he sailed, he ran down all in his path, often capturing the victims for his cannibal feasts, for it was the rule in Fiji that all who were upset or wrecked were regarded as sacrifices to the gods. Indeed, the gods of Fiji were themselves cannibal ghosts of dead chiefs and fed upon the spirits of those who were sacrificed.

Wilkes gives a description of the coming of Tanoa to a conference held upon the U. S. S. *Vincennes* in August, 1840;

> **The canoe of Tanoa, the king of Mbau, was discovered rounding the southern point of the island of Ovalau; it presented a magnificent appearance with its immense sail of white mats; the pennants streaming from its yard denoting it as belonging to some great chief. It was a fit accompaniment to the magnificent scenery around, and advanced rapidly and gracefully along; it was a single canoe, one hundred feet in length, with an outrigger of large size ornamented with two thousand five hundred of the Cypræa ovula shells; its velocity was almost inconceivable, and every one was struck with the adroitness with which it was managed and landed upon the beach.**

Often when Tanoa returned to Mbau from his murderous raids children yet alive were to be seen suspended by an ankle or wrist from the yard-arm of this canoe, and so common was this practise that such were called in derision Manu-manu-ni-latha (birds of the sail).

The later years of this inhuman monster were disturbed by dissentions and by the rebellions of his sons. Yet when he came to die he smiled with his last breath when told that five of his wives were to be strangled to accompany him into the world beyond.

Throughout his reign, Rewa and Mbau were almost constantly at war, but every now and then Tanoa would command the Rewa chiefs to come to Mbau to beg pardon for their temerity, which they always did, even if victorious.

Tanoa lived to be nearly if not quite eighty years of age, a rare occurrence in Fiji, for they believed that as they were at the time of death so would they be in the world to come. Thus doubly did they dread the infirmities of age, and people who passed middle life commonly requested their nearest relative and friends to strangle or bury them alive. Thus died the great chief Tuithakau (king of the reefs) of Somo somo, an event of which the missionary Williams gives a detailed and graphic description. Tuithakau was described by Commodore Wilkes as

> a fine specimen of a Fiji Islander; bearing no slight resemblance to our ideas of an old Roman. His figure was particularly tall and manly and he had a head fit for a monarch. He looks as if he were totally distinct from the scenes of horror that are daily taking place around him, and his whole countenance has the air and expression of benevolence.

In August, 1845, this old aristocrat became feeble after prolonged illness, and one day he announced to those around him that the time of his death had come. Two of his wives were then adorned in gala attire and strangled by their kindred, while the old king was covered with charcoal pigment, the chieftain's turban of masi placed upon his head, and a string of whale's teeth around his neck. Then the chief priest blew two blasts upon his triton shell, and after an interval turning to the old king's son he said "True the sun of one king has set, but our king yet lives." Then the aged man was carried out through an opening torn through the wall of the house, as is the custom to-day at Fijian funerals, and they placed him upon the bodies of his two dead wives who lay upon the mats within the grave, and as the earth was thrown over him he was heard to cough beneath the ground. Sixty of his subjects then cut off their little fingers, fastened them upon reeds and thrust them into the thatch along the eaves of the dead chief's house. So respected was this custom of burying the aged that for a whole year at Somo Somo the missionaries heard of but one natural death of an adult, and Wilkes says that among over 200 natives at Savu Savu he saw not one over forty years of age.

(To be continued)

THE LIBERAL ARTS AND SCIENTIFIC MANAGEMENT

By Professor GRANT SHOWERMAN
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THERE are no doubt a great many easily attainable data which the general public or its individual members, in the effort to improve civic or industrial affairs, may well employ some one to collect and set in order for them. There may even be some justification for the existence of the professional investigator, though there is the greatest danger that as a class and in the long run he will do more harm than good by seeing too much or seeing awry.

It is safe to say, however, that not even the professional investigator will ever fathom the mystery of the college professor—and of course I mean him of the less demonstrable sort, the professor of liberal arts. Man is an ingenious animal, and the professional investigator is a superman, but there are limits to human capacity.

If the professional investigator ever compiles an intelligible report on the college professor, it will be either because he himself is a college professor, or because he takes the word of the college professor; and even then it will satisfy neither professor nor public.

It would be surprising indeed if a college professor—a real college professor, I repeat, one of the useless kind; not one of the kind whose services are so easily translated into money, and who are really nothing but business men—it would be a great surprise if a real college professor ever undertook a "survey" of his fellows. He knows too much about the nature of their calling. Next to the ministry, or even beyond it, the profession of liberal arts is removed from the rough business of life, and occupies itself with the affairs of the mind and soul. The religious life and the intellectual life have always set their own standards, and always will. Both of them know and feel what they are aiming at, and they alone really know. The world may indeed fix the manner and amount of college receipt and expenditure, but the purposes and methods and results of liberal education have never been susceptible of "scientific management," and never will be. The world's inability to set standards, or even to comprehend them, is proved by its very attempt to investigate. Investigation is really an avowal of the intention to force the liberal arts into the moulds of worldly business. Were the intention to succeed, the result would be, not liberal education, but worldly business.

It would be quite as surprising if the college professor attempted to give "scientific" answers to the questions of the professional investigator. The last thing that either the professor of liberal arts or his disciples would attempt is a scientific or "practical" demonstration of

his efficiency. He is unable to demonstrate it, in the ordinary sense, even to himself, to say nothing of the world.

Add to these reasons that even if the college professor could demonstrate his importance, he would be the last man to do so in the blanks of a questionnaire, and you have my excuse for presuming to speak for him when the professional investigator is already in the field.

I

The college professor's work may be considered in several aspects.

The first of these aspects is the one most familiar to the general public, and is consequently the basis on which his work is usually estimated. This is the classroom aspect.

But even this aspect is only superficially understood. The profession of teaching is thought of as an occupation in which a certain amount of previously acquired knowledge and method is applied in routine. It is like the goldsmith's occupation, or the dentist's, or any other calling with fixed office or working hours. The professor of liberal arts himself is thought of as a person who spends a minimum of time in routine work, has a great many unemployed hours during the school year, and during a very long vacation is absolutely free.

The fact is, however, that the average college professor spends almost as much time in class room and office as the average clerk in the employ of corporation or state. Count in the time he is in the laboratory and office before and after classes—in faculty and committee meetings, in conferences with individual students and colleagues—and you will find him employed more hours than the clerk. Count in the time he spends after these duties are done—in reading and correcting themes, exercises and notes, in reading and refining on the lessons and lectures of the next day—and you will find him far exceeding the limits of the carpenter's and bricklayer's day, and even that of the common laborer.

Nor is this all the time and effort he expends. The professor's work is never out of his mind. Coming or going, eating and drinking, the college and its affairs are always with him. If he is not talking of them or doing them, he is thinking of them. The Saturday which he is supposed to give up to recreation is more likely than not a busier intellectual day than the others. The Sunday which he is supposed to devote to worship and meditation is also given in no small part to reading and thinking which inevitably center about the college work. His very recreation becomes, in spite of him, a part of the college business. He walks with a friend, and they discuss college problems. He reads with his wife, and they choose their magazine articles and books with a view to the effect upon his college work. He engages in physical exercise, and it is for the sake of intellectual efficiency. The significance to him of red blood is that without it he can be neither inspired nor inspiring. And the long vocation—on that, too, he looks with the professional eye. The long vacation is his great opportunity for the reading and writing

that routine work has made impossible during the year—for the renewal of his intellectual storage batteries for another year. More likely than not, he does less reading and writing than he desires because he knows that his physical and nervous batteries also need re-storing.

The physical and nervous expenditure of the college professor's life is not usually appreciated. Talk is cheap, we are told, with the implication that it is easy, and there is no denying that to some kinds of people some kinds of talk are both cheap and easy; but the sustained talk of a fifty-minute lecture, or the almost sustained talk of a recitation period, especially if the lecturer or teacher is warmed with enthusiasm, is not a task to be repeated many times on the same day without a manner of exhaustion far different from mere bodily fatigue, and more lasting. It should surprise no one that men and women who spend five days of the week in work of such intensity, and two more in work that differs only in degree, feel at the year's end the need of a prolonged period for recuperation.

The college professor does not measure his time—which means that he also does not begrudge it. And the reason why he does not is that in the main his pleasure coincides with his duty. He gives his time ungrudgingly because he likes to. I do not forget the fine bits of humor about the professor—"a man with not enough brains to be a clerk, and too little muscle to dig ditches." As a matter of fact, he is a college professor because he is fitted for and enjoys the intellectual life, and because he has followed his bent. Almost, if not quite as much as the clergyman, he has been "called." He has not selected his vocation; his vocation has selected him. And almost, if not quite as much, with him as with the clergyman, salary is but an accident of vocation.

The college professor's liking for his work, together with his comparative liberty, is no doubt responsible for the impression that he has an easy time. In one way, the impression is well grounded. He does enjoy a degree of liberty, for his vacations are long and his work elastic. Time does pass rapidly and easily, because he is for a great part of it absorbed in congenial tasks. Of the necessary drudgery of the profession, let us say nothing here. If it is criminal to accept pay for what one likes to do, he is indeed an offender.

But it should not be forgotten by the efficiency zealots that the college professor and his work represent an all-important principle in scientific management. Congeniality of task is a great factor of industrial economy, and the greatest promoter of both the employer's material interest and his peace of mind. The liberal arts professor's critics should remember that actual enjoyment of occupation is a greater stimulus to working well and working long than any office regulation or promise of salary.

The college professor is working hours enough. Not infrequently, he is working too many hours for either his own or the general good. The clear head and the buoyant heart are as indispensable to teaching

as to preaching—one of them perhaps more so—and neither is possible to the jaded man. Should benevolent legislation—or professorial trades-unionism—get far enough to forbid the professor's working more than eight hours a day, or after six o'clock, or with too great rapidity, it is conceivable that in respect at least of buoyancy his work would be improved.

The college professor is working hours enough, and he is earning his salary. I am not going to make a display of statistics here. They could be made to prove a great many things—among them, that it is no wonder college professors marry late, have few children, and seem glad of the opportunity to earn a few dollars outside the college walls. But statistics are always under suspicion of perjury, so it will be just as well, and much simpler, merely to repeat that the professor is earning his salary, and to let it go at that. For my first year's instruction, in one of the many "greatest universities in the world," I received eight hundred dollars and the satisfaction of hard work in fields I liked. One hundred dollars went for books, and I was married. To qualify for this position, I had spent four years as undergraduate and four years more as graduate, two of them in Europe. Salaries may have advanced somewhat during the past fifteen years, but the prices of wives and babies, and other necessities of a really human life, have shown them a clean pair of heels.

This is not a complaint—at least, not an ill-natured complaint. There is no doubt that if college professors in general, especially those in the smaller institutions, were better paid, the level of ability in the profession would be raised. Books, travel and study abroad, are the great means of growth in the intellectual life, and there are very few who can afford them. But there is no great reason for thinking that a rise in salaries on a large scale would have the commensurate effect upon teaching. There may be some truth in the assertion sometimes made that the brightest and most capable young men in college are attracted to the more highly paid professions, with the implication that the teaching profession suffers; but there is not much cause for worry on this account. Any professor of experience will say that among all these "bright and capable" young men there is only once in a while a real *mind,* and that the peculiar combination of mind and soul that constitutes the ideal of the teacher is even more rare; and that the young man who possesses the combination rarely fails to enter the teaching profession—naturally, and not for the financial reason.

It would be a sorry event for liberal education—and for technical education too—if the principles of scientific management were really applied: if the professor's preparation were formally prescribed, if hours were fixed and tasks made absolutely definite, if promotions and salaries were determined as in the business world, and all the worldly ways of inspection, stimulation, and compulsion were introduced. There is already too much of all this—too much talk of "units," of the "instruc-

tional force" and the "educational plant," of "efficiency" and "output," of "investment" and "returns." One university not more than a thousand miles from where I sit has a noon whistle. If things keep on at this rate, some day when it blows, some hungry or time-grudging scientifically managed professor will drop an expensive piece of apparatus, and the state will pay dearly for its whistle.

No one, however, need worry lest this sorry day come in very truth. Teaching is an inspirational calling. Love of the intellectual life is its foundation and its effect. Inspiration may not be handled, weighed, measured, bought or sold. No college professor ever succeeded because he was "managed." The possible loss through irregularity in the college professor's work is nothing compared with the certain loss should he learn to work in the spirit of the clerk or the union man.

II

A second aspect of the college professor is less familiar. I mean that in which he is seen in the larger or richer institutions, where the greater amount of money has made it possible for him to realize more fully the ideals of his class.

It is in this second aspect that the college professor is most freely criticized. The general public, usually in the person of some one with a political or journalistic axe to grind, runs an eye through the columns of the semester program, and is surprised to find a professor scheduled for twelve hours, or ten, or even as few as six.

"Six hours!" exclaims the general public. "But of course that means six hours a day."

"No, six hours a week. Be assured of the incredibly outrageous fact."

The general public is aghast.

"What? Three thousand dollars a year for teaching six hours a week for nine months? Why, that's $13.888888 . . . an hour!"

No wonder the general public is aghast. It was scandalized even before, when told of the professor in the smaller institution who received a smaller salary for four or five times the instruction. If it is the case of a state institution, and the general public pays the professor's salary and owns him, there is likely in these days to be at least the threat of investigation and "general cleaning up." For the public has been educated by the professional demagogue to assume that dirt is normal.

The demagogue does not encourage the public to reflect. It would interfere alike with his pleasure and his profit.

And yet reflection is easy. Like the professor in the small college, the university professor has administrative duties. He is chairman of a large department, perhaps, and that sometimes means oversight of the work of a score of instructors and the expenditure of large sums for books and apparatus. If he is not, he must nevertheless keep office hours, attend meetings and conferences, conduct a correspondence with

teachers' agencies, school boards, and alumni, answer questions, make reports, and perhaps inspect schools. He must attend various association meetings, local and national, whose work is an integral part of his profession. He has social duties which are in reality professional—departmental dinners, the entertainment of visiting scholars and lecturers.

Last of all, he must prepare for the six hours, for which he is there first of all. If the general public would examine only a little more closely, it would perhaps find that all the six hours consisted of lectures, or the conduct of graduate work, and that they required a great deal of writing and an incredible amount of reading. A lecture in the history of the fine arts may involve the reading of two or three recent books. A lecture in science may entail a week's work in the preparation of experimental apparatus. One sitting of the seminar may require the examination of half a dozen technical articles. This kind of work is different from the mere teaching of how to construe a sentence, how to solve a problem in algebra, or how to perform a chemical analysis. The greatest and most depressing burden of the professor with few hours of instruction is the obligation to keep abreast of his subject—an obligation which it is impossible for even the minutest specialist in the longest established subject fully to meet.

If the general public will use pencil and paper after all the facts are in, it will find that, instead of six hours in the week for nine months in the year, the college professor is spending on the average eight hours a day for six days in the week through the whole of the year, and that, instead of $13.888888 . . . an hour, he receives $1.201923072692 . . .

This is for expert service in a profession requiring unusually protracted preparation, and involving social relations with the best paid classes of the community. If the college professor were a mere scientific manager of time and money, he would be insane to continue in a profession which never makes him rich, which brings him on the average only a living, and which is frequently a luxury made possible only by independent means. And yet there are those who think that the professor himself should be scientifically managed. What does keep him at work and give him value at all is something incalculable—an internal, driving, not an external, compelling force; and neither scientific management nor trades-unionism has yet learned to deal with internal, driving forces.

III

There is a third aspect of the liberal arts professor's function which is still more imperfectly appreciated by the ordinary public.

The college professor is an expert. Like all other experts, he is the means of contact between the mind of the public and the mind of learning. These two minds are unable to communicate with any degree of ease; the world, with all the business it has to do, can not hope to find

time for the examination and sifting of the immense piles of fact that constitute the great bodies of knowledge.

The professor is an interpreter. He receives, transforms, and transmits. If he is a professor of science, he interprets the world of nature. If he is a professor of art, he interpret's ideals of beauty. Without his services, art and science would be to the general run of mankind "a mere arrangement of colors, or a rough footway where they may very well break their shins"—to use a phrase from Stevenson. If he is a historian, he interprets the past, and the present in the light of the past. If he is a professor of literature or philosophy, he interprets the wisdom, the emotion, and the conduct of human experience. He is a mediator between his own generation and generations gone. He bridges the chasm between the modern and the ancient, the quick and the dead. He is the lens that gathers and brings to a focus the thousand rays of knowledge. He is second only to the artist in helping the race to remember what it has done, and how, and why, and to what purpose. The artist made the records; the professor of liberal arts interprets them.

And the professor of liberal arts is not an interpreter only. He is an apostle. There is an intellectual life, as there is a spiritual, to enter which ye must be born again. The professor is the priest of this life. His great ambition is to bring minds into the intellectual kingdom. He guides, inspires, converts, baptizes, ministers. Outwardly, he is concerned with concrete instruction; in reality, he is much more concerned with the quickening of the mind. The kingdom of the intellectual is within you. To say it once more, the professor's calling is inspirational. If at any time inspiration fails him, nothing so makes him unhappy, nothing is so missed by his students. The tongues of men and angels can not make up for it.

There is a still larger service of the intellectual expert upon which the public rarely reflects. The college professor has a function and a duty beyond the class room, beyond his community, beyond his state. To put it in a word, it is the college professor, first of all, who is responsible for the intellectual standard of the world.

The direct personal contact of the professor with his students is of course one means of his contributing to the world's intellectual ideals. Through the scattering abroad of alumni his ideas are disseminated and his spirit communicated to society in general. But this is only one means.

It is in taking for granted that this indirect contact with the world is all, that the unreflecting are most mistaken. The college professor's work must not be thought of too much in terms of recitation room and students. The professorial class has its ways of reaching the world at large directly as well as indirectly. The liberal arts professor contributes to the intellectual life of his own community in the lectures and

papers which he is so freely called on to give. He carries his message to the confines of state and even of nation. He may be invited to carry it to the great centers of the whole intellectual world. Still further, he contributes by means of the written as well as the spoken word. In the main, the solidly intellectual product of the entire press, whether in technical or popular form, whether in magazine or book, is the work of his hand. Even the lighter product is mostly the work of his disciples.

Add to interpretation, dissemination and inspiration, the duty of discovery. The college professor's function includes not only the increase of knowledge in the individual and the elevation of the intellectual standard in the world at large, but the actual advancement of learning. College and professor alike are not for their own campus alone, but for society in general.

Naturally, the delivering of lectures and the writing of articles and the conduct of experiment and research can not be done by men who consume most of their time and all of their energy in the recitation room and office. This is where the ignorance and narrowness of those who would scientifically manage the professor's time are most clearly manifest. The cry of "students and class room first," like other demagogic cries, never fails to win a measure of applause.

There are two considerations, however, upon which the critics of these activities should be taught to reflect. One is that, as a matter of fact, other things being equal, professors who lecture, write, and engage in research, are better teachers than those who do not. The professor who is not engaged in this way does not grow. Long continued power of inspiration depends upon continual growth, and growth depends upon continual discovery. It may be discovery, for the general intellectual world, of what has not yet been known, or it may be discovery, for the professor himself, of what the world of intellect already knows—the conquest of the intellectual heritage which none of us can possess *without* conquest; but discovery of some sort is essential both to usefulness and happiness, because it is essential to freshness and vigor of growth. The other consideration has already been mentioned—the relation of institutions of learning and their faculties to the world of universal learning.

The college professor with the six hours is not denying himself recreation and health for selfish ends, except as some little craving for distinction moves him. Least of all is he investigating and writing books because he will be paid money for it. He studies and publishes because he is impelled by the law of his being and the ideal of his calling. The intellectual life is, and always has been, a freemasonry. Learning is, and always has been, almost as much as religion, without money and without price. The apostle of scientific management who imagines that it may be dealt with after the manner of a commodity,

is ignorant. The state that attempts to follow his counsel is stupidly, even if unintentionally, illiberal and uncivic.

As to whether the advancement of learning and the elevation of the intellectual standard constitute a benefit to the state, any one who has read of dark ages and ages of enlightenment, or is acquainted with cultivated men and ignorant, or has lived in intellectual and intellectless centers, may settle the question for himself. It is the difference between running water and the stagnant pool.

And further, as to the uses of advanced scholarship in the liberal arts. The public is familiar with the absurdities of the dry-as-dust professor, and takes great credit to itself when it more or less good-humoredly tolerates him. It does not stop to think that the books and articles and lectures which are its own sole means of intelligent thinking about the past and present of nature and mankind are possible only because of the patience and devotion of those same dry-as-dust professors, who have searched out the details of fact from which enlightened conclusions could be drawn. It does not stop to think that knowledge has always proceeded from above downward—which is only another way of saying that not all men can be leaders, and that progress is always a matter of leadership.

Least of all does the public stop to think, while clamoring for the practical and discouraging the liberal arts, that pure learning, learning for the mere satisfaction of the learner, has always preceded applied learning. Necessity may be the mother of invention, but pure science has always been its father, and pure science is dependent for its spirit upon the household of pure learning.

IV

There is still another aspect of the liberal arts professor. So far, it is his active side that we have considered. But his contribution to society lies not only in the services of teacher and scholar. It lies also in his personal qualities. More than the members of almost any other profession or class, he contributes by Being, as well as by Doing.

With the college professor, too, Being is not, as it is in the case of most professions, an accident. It is a duty strictly required of him. The college professor must be clean-lipped and clean-hearted, honest and honorable. In what other calling, except the ministry, does a single instance of scandal involve immediate dismissal? The world is as strict with the college professor as with priest or pastor. "If a man desire the office of professor, he must be blameless, the husband of one wife, vigilant, sober, of good behavior, given to hospitality, apt to teach; not given to wine, no striker, not greedy of filthy lucre; but patient, not a brawler, not covetous. Moreover he must have a good report of them which are without; lest he fall into reproach and the snare of the devil."

Not all the good qualities of the college professor, however, are prescribed. He possesses some characteristics that grow more or less spontaneously out of the nature of his calling. They are not characteristics which he in any way puts on the market; but they nevertheless make his class one which the world in general may contemplate with advantage to society.

He is usually an example of professional and civic generosity. He gladly gives to his work more than the legal requirement of time, he shares his knowledge freely with the community and the world, and he contributes to local religious and civic enterprise proportionally more in time and money than the wealthy professions with whom he is socially ranked. His hardest work, the scholar's research, is done without thought of money. If he takes money for a lecture or other expert service, it is never in the spirit of the ordinary expert. He takes it with something like self-accusation, feeling it an offense against conscience. In the rare, very rare, instances when his pay is more than "nominal," he wraps it up in the term "honorarium" before handling. There is no better proof of his usual attitude toward compensation of this kind than the surprise and sneer of the worldly man when the college professor presents a bill. It is as if a clergyman should charge for funerals. It is a salutary thing for society to have in its midst one class of men who demonstrate the possibility of the uncommercial life.

The college professor is an example of the workman in love with his work, the citizen unenvious, ungrudging, unmeddling, and clean of heart. Old Cato's words on the farmer describe him as well: "They that are occupied in that pursuit are least given to evil counsel." It is a good thing for the state, in these times of asserting rights and complaining of duties, to have also some sons of this sort. It has plenty who are not.

The college professor is a pronounced example of courtesy—courtesy of manners and courtesy of mind. He is tolerant and charitable. The habit of his life is the weighing of evidence. His first impulse is to seek his opponent's point of view. Courtesy with him has no connection with commerce.

His influence is also for cosmopolitanism and internationalism. His is the one class to whom traveling is a business as well as a pleasure. He belongs to national and international organizations, and is likely to have personal and epistolary acquaintances in all the intellectual nations of the earth. His is the one class in America that knows the languages of other peoples, and enters into their souls. As a consequence, his heart and his voice are always for brotherhood and peace.

He is a force for conservatism. His teaching and thinking are concerned with the widening of his own and his students' horizon—abroad in space to foreign lands, and abroad in time to ages past. He realizes as no one else the immensity of geologic and human experience, and the

fallibility of human effort. The habit of looking for permanent values is inbred in him, of disregarding the external and the temporary. To him, "the eternal verities" is no idle phrase. He has a natural distrust of new and over-facile schemes. He is given to contemplation rather than action. He is a brake, a balance wheel, a governor, a partial correction to the shouting optimism of enthusiastic ignorance.

He is a force for idealism. He is exceptionally free from contact with the sordidness of life. His converse in letters, art and history is with the beautiful and the noble in human thought and conduct. His duty involves the constant effort to reintroduce into human life the emotional experience of the past. Imagine the idealism of the liberal arts entirely removed from higher education; you will see life appreciably harder and more sordid.

V

The duty of the liberal arts professor is thus best described as a duty of Being. He must Be master of his subject. He must Be familiar with the general field of knowledge. He must Be intelligent in his thinking and in his feeling—which means that he must Be cultivated. He must Be inspired. He must Be an irradiator of inspiration. He must Be pure in his living.

All he has to Do, according to the standards of worldly business, is to instruct young men and women at certain hours of the day. According to worldly business, too, he should be scientifically managed. He should be made to Do as much as other men, and the effects of his Doing should be concrete and measurable.

But whatever this Doing accomplishes must be conditioned upon the thoroughness of the Being, and Being is not susceptible of measurement. In the same way, the most important result of his instruction, and its greatest value to the student and the state, lies in the Being which is the source of all best Doing in the individual citizen; and this, too, is not susceptible of measurement.

Scientific management applied to the liberal arts—or to any other teaching—is the most unintelligent of self-contradictions. To insist on the college professor's Doing more is to compel his Being less. If society does not want him and his influence, let it abolish his office. If it does want him, it should remember that the application to him and his work of rules from the industrial world would be equivalent to abolition.

The professor who is a failure is taken care of. He is discovered and put in his place—not by regents or trustees, and least of all by a professional investigator, but by his fellows. He is not the real thing. In the case of the professor who is the real thing, the more the talk of Efficiency, the less the Service.

Not all the good qualities of the college professor, however, are prescribed. He possesses some characteristics that grow more or less spontaneously out of the nature of his calling. They are not characteristics which he in any way puts on the market; but they nevertheless make his class one which the world in general may contemplate with advantage to society.

He is usually an example of professional and civic generosity. He gladly gives to his work more than the legal requirement of time, he shares his knowledge freely with the community and the world, and he contributes to local religious and civic enterprise proportionally more in time and money than the wealthy professions with whom he is socially ranked. His hardest work, the scholar's research, is done without thought of money. If he takes money for a lecture or other expert service, it is never in the spirit of the ordinary expert. He takes it with something like self-accusation, feeling it an offense against conscience. In the rare, very rare, instances when his pay is more than "nominal," he wraps it up in the term "honorarium" before handling. There is no better proof of his usual attitude toward compensation of this kind than the surprise and sneer of the worldly man when the college professor presents a bill. It is as if a clergyman should charge for funerals. It is a salutary thing for society to have in its midst one class of men who demonstrate the possibility of the uncommercial life.

The college professor is an example of the workman in love with his work, the citizen unenvious, ungrudging, unmeddling, and clean of heart. Old Cato's words on the farmer describe him as well: "They that are occupied in that pursuit are least given to evil counsel." It is a good thing for the state, in these times of asserting rights and complaining of duties, to have also some sons of this sort. It has plenty who are not.

The college professor is a pronounced example of courtesy—courtesy of manners and courtesy of mind. He is tolerant and charitable. The habit of his life is the weighing of evidence. His first impulse is to seek his opponent's point of view. Courtesy with him has no connection with commerce.

His influence is also for cosmopolitanism and internationalism. His is the one class to whom traveling is a business as well as a pleasure. He belongs to national and international organizations, and is likely to have personal and epistolary acquaintances in all the intellectual nations of the earth. His is the one class in America that knows the languages of other peoples, and enters into their souls. As a consequence, his heart and his voice are always for brotherhood and peace.

He is a force for conservatism. His teaching and thinking are concerned with the widening of his own and his students' horizon—abroad in space to foreign lands, and abroad in time to ages past. He realizes as no one else the immensity of geologic and human experience, and the

fallibility of human effort. The habit of looking for permanent values is inbred in him, of disregarding the external and the temporary. To him, "the eternal verities" is no idle phrase. He has a natural distrust of new and over-facile schemes. He is given to contemplation rather than action. He is a brake, a balance wheel, a governor, a partial correction to the shouting optimism of enthusiastic ignorance.

He is a force for idealism. He is exceptionally free from contact with the sordidness of life. His converse in letters, art and history is with the beautiful and the noble in human thought and conduct. His duty involves the constant effort to reintroduce into human life the emotional experience of the past. Imagine the idealism of the liberal arts entirely removed from higher education; you will see life appreciably harder and more sordid.

V

The duty of the liberal arts professor is thus best described as a duty of Being. He must Be master of his subject. He must Be familiar with the general field of knowledge. He must Be intelligent in his thinking and in his feeling—which means that he must Be cultivated. He must Be inspired. He must Be an irradiator of inspiration. He must Be pure in his living.

All he has to Do, according to the standards of worldly business, is to instruct young men and women at certain hours of the day. According to worldly business, too, he should be scientifically managed. He should be made to Do as much as other men, and the effects of his Doing should be concrete and measurable.

But whatever this Doing accomplishes must be conditioned upon the thoroughness of the Being, and Being is not susceptible of measurement. In the same way, the most important result of his instruction, and its greatest value to the student and the state, lies in the Being which is the source of all best Doing in the individual citizen; and this, too, is not susceptible of measurement.

Scientific management applied to the liberal arts—or to any other teaching—is the most unintelligent of self-contradictions. To insist on the college professor's Doing more is to compel his Being less. If society does not want him and his influence, let it abolish his office. If it does want him, it should remember that the application to him and his work of rules from the industrial world would be equivalent to abolition.

The professor who is a failure is taken care of. He is discovered and put in his place—not by regents or trustees, and least of all by a professional investigator, but by his fellows. He is not the real thing. In the case of the professor who is the real thing, the more the talk of Efficiency, the less the Service.

THE CELIBATE WOMEN OF TO-DAY

By EARL BARNES
PHILADELPHIA, PA.

THERE were in the United States, in 1910, 8,924,056 women, over fifteen years of age, who were neither married, widowed nor divorced. These single women represent twenty-nine and seven tenths per cent. of all the women over fifteen years of age in the United States at that time. Many of these women have since married or will marry; but at every age there remains a large number of unmarried women facing a life of celibacy. Thus of native-born white women between the ages of twenty-five and thirty-four, thirty and six tenths per cent. are unmarried, while of the same class, between the ages of thirty-four and forty-four, seventeen and eight tenths per cent. are still single. The public school teachers of America, alone, number nearly 400,000 mature women, hardly any of whom are married. Why do they not marry, and what compensations can a life of celibacy bring them?

In the first place, it is a mistake to imagine, as most people do, that the emancipation of women since 1870 has tended to discourage marriage. The contrary is true. In 1890, but sixty-eight and one tenth per cent. of American women of fifteen years of age were married, or had been married; in 1900, this proportion had risen to sixty-eight and six tenths per cent.; and in 1910, it was seventy and three tenths per cent. Higher education, industrial independence and increasing participation in social and political life have apparently increased the tendency of women to marry. But why, since they have so rapidly taken possession of nearly everything else, have they not more generally taken possession of husbands?

The widespread belief that there are not enough men to go around is another old superstition. The men have outnumbered the women in the United States at every decennial census since 1820. In 1910, there were in the whole country 2,692,288 more males than females. Of course, this is partly due to the fact that more male than female immigrants come here to work.

But even among the native-born whites, there were in 1910, 922,502 more males than females. In that year there were 102.7 white native born males to each 100 native-born females. Only in Massachusetts, Maryland and North and South Carolina was there an excess of females. Counting only the people over twenty-one years of age, there were 110 males to each 100 females in 1910; and even among the native-born whites there were 106.8 males to each 100 females over twenty-one years of age.

There have always been women living apart from family life, at least during the historic period. For obvious reasons, men have almost universally considered female celibacy a matter of reproach, and they have even invented such makeshifts as child marriage in India and sealing among the Mormons that unfortunate or undesirable women might be spared the disgrace of dying unmarried. At times, a lack of dowry has condemned the least attractive women to live alone; and the offices of religion have imposed celibacy for at least a part of life upon groups like the Vestal Virgins in Rome and for the entire lifetime upon nuns and other Christian recluses. In none of these cases, however, did women choose to live alone because they hoped thereby to realize a fuller life than they could find in the married state. In the religious orders, they dedicated their virginity to the service of the Deity, and at most hoped to profit in the life to come for their loss on earth.

This is the great difference between celibate women of the past and those of the present time. With our enormous number of unattached men, it would be foolish to imagine that the great majority of single women in America could not marry if they wanted to do so. Man proposes, but woman dictates when he shall do it. Why do so many women elect to walk through life alone?

Doubtless the growth in democratic ideals, which has been steadily working among women since 1870, has had much to do with it. Women have ceased to be merely "the sex"; they have become individuals. Under simpler conditions of life, such as prevailed in our colonial period, if a woman found a man of her race, religion and social position, who was personally agreeable to her, little more was necessary to insure a happy marriage. But now a woman seeks fulfillment not only for her personal liking, but for all the qualities of her varied personal life. She has not only racial, religious and social interests, but she has an intelligent attitude towards the whole of life; she has musical, dramatic or literary tastes; she is interested in social justice or in the vested interests of caste; she cares for travel or she desires a quiet home; and in a hundred other directions she is an individual. Such a complex individuality does not easily find its complement. A person who merely likes music can generally find it; a person with a cultivated musical taste must search for music that suits him.

All this uncertainty is emphasized by the examples of marital unhappiness that intrude themselves on every hand. We have in our midst nearly a million divorced people. The deserted wife and mother is one of the greatest and most common problems that confront social workers. Our funny papers find the majority of their humor in deceived and deceiving wives and husbands. The drama and the novel burden us with sex problems. Yellow journalism lives on the tragic

side of married infelicity. Of course, there are millions of happy marriages, but such happiness, like good health, is inarticulate and does not advertise itself in the market place.

Every self-supporting girl must also be deeply impressed with the difference between her own economic position and that of her mother. For years, as a girl, she has seen her father and mother working together as life partners; and she has seen all the net income recognized as her father's personal property. Her mother's relation to the family purse has generally been that of a medieval serf to his lord's estate. Even the house furnishing and the mother's own clothes have often been secured by stealth and indirection. Now the girl has her own pay envelope, and in possessing it absolutely she holds the key to life as she desires it. It is not to be wondered at that a young woman in full possession of youth and health finds it difficult to give up a salary which, even if small, is absolutely her own, to accept a feudal relation to some man's salary, often not much larger than the one she has earned, knowing it must suffice for two and probably for more.

Of course, this feeling fails to recognize the danger of the passing years. With the blindness of youth, it over-emphasizes the value of present liberty. Later, she may see the day when she will realize that she has sold her birthright for a pay envelope. But it is not so much the amount of the income that really troubles the modern woman as it is her personal relation to it. Surely some means might be devised by which a woman could be related to the family income so as to preserve her independence and self-respect as well as that of her husband.

Another difficulty that confronts the young woman of to-day in her search for the altar is her superior intelligence. This is generally less important than it seems, but in a country which worships popular education and where all parents hope to give their children at least a better education than they have had, correct grammar and a speaking acquaintance with Robert Browning and Michael Angelo acquire a value out of all proportion to their power to function in life. When a likely young man comes courting who says, "You and me will go," and prefers the movies to Ibsen, it makes the young woman who aspires to culture question the long evenings of a lifetime.

This is especially true of the young woman who has risen intellectually and economically above her social class. Skilled preparation has given her an income superior to that of the men in the group where she was born; and she has been too busy studying and working to make social connections in the class where she thinks and works. The social emancipation of woman lags far behind her intellectual and economic freedom, so that these young women whom we are considering still move socially in their family planes. The men in that group are too ignorant and too poor to suit her; and the men with whom she works

know her only as a stenographer, a teacher or a journalist. Our last census returns show how widespread this condition is, for except in New England, there is no excess of men in the cities. But in the countryside the excess of men is great, for they have been left behind in the struggle towards larger intellectual and economic independence whch has swept the young women into the towns.

These women, possessing a fairly large intellectual and professional life, often move in a pitifully narrow social circle. The home, as a center for social activity, has been sadly squeezed in our emigration from the country into the city. Friends and acquaintances come less often than in the past to spend a few days with the family. Calls are more formal and brief. Acquaintances less often drop in for a meal; and meantime the older social conditions that limit a woman's initiative in making acquaintances still hold and are broken by young women only at considerable risk.

Even public meeting places are apt to be restricted to one sex. If the girl joins a club, it is a girl's club; if she joins the Y. W. C. A., the young men are a half mile away in the Y. M. C. A. When shall we be wise enough to turn both these institutions into Young People's Christian Associations? And meantime, while the hunting field is narrow the difficulty of selection has increased. A generation ago, as we have pointed out, a girl might hope to find a desirable mate among a dozen acquaintances. Now she needs to look over a hundred young men to find her own.

In the light of this analysis the wonder is not that we have so many unmarried women in America, but that we have so few. Nature has loaded the dice in favor of marriage and she generally has her own way. Many of these young women, however, will never marry. Nuns will continue to vow their virginity to the Celestial Bridegroom; reformers will spend their lives in securing social justice for their sisters and for their sisters' children; professional women will continue to seek fame and service; teachers will fight off the wars of the future, not with submarines and aeroplanes, but with ideas and ideals planted and nourished in young minds. Many other women, with no particular devotion to sustain them, will be held by the charm of pay envelopes and independent latch keys until it is too late; while the accidents of fate will leave many stranded in their struggle towards a complete life.

Meantime there can be no doubt that the most complete life a woman can live, at least between the ages of twenty-five and forty-five, is found in a marriage based on a deep and lasting love; and the same is no less true for a man. What, then, has our modern life to offer to celibate women as compensation for the life they do not attain?

There are at least certain negative values which come to them.

In escaping vital experiences, the woman can at least recognize the fact that she also escapes the anxieties and troubles that are inseparable from family life. She will probably be lonely; but, on the other hand, when she wishes it she can be alone. In writing to a friend, who had lost his little daughter, Cicero says that all men would wish children were it not for the anxiety that they inevitably bring.

To put it more positively, the celibate woman retains her freedom of action. Through study, travel, art, science or society, she may reach a degree of self-realization not always attained by her sister who marries. Into her work she can carry much of the enthusiasm and devotion which, as wife and mother, she might lavish on husband and children.

The desire for service, which lies so deep in the nature of all good women, can often be more fully realized in a life of personal freedom than in one of marriage. At least there may be a different realization of very great value to the individual and to society. Such women as Clara Barton, Susan B. Anthony and Jane Addams have brought gifts of service to mankind far beyond what they would probably have given in their own homes. Each of these women probably recognized her personal loss; but many devoted wives and mothers have also recognized their loss through inability to enter into the wider service of public life. Unto no mortal is it given to live all the possibilities of life.

But more important than any of these compensations we have named is the power we all possess to live life vicariously. Our real living is never in the mere possession and use of things, but in what we think and feel about them. Lower animals live in facts; man lives in his ideas and ideals. All of life's values must be found on the way; when we arrive we are always in danger of becoming unconscious and so losing what we came to get.

This is why art and literature have always had to find their characters in the struggling classes, the poor and the rich. The smug middle classes and the comfortably rich have the facts of existence; but they do not know it. The universal contempt of those who know for such unconscious living finds expression in the terms bourgeoise, philistines and bromides.

On the other hand, struggling and self-conscious groups always attract and interest us. Bohemia is poor; it lacks the facts of property; but it has the most alluring of all festivals and immortal banquets. Who, that has a soul as well as a stomach, would not turn from a banquet of facts at twenty dollars a plate, with dull unconsciousness of life in the people, to a group of dreamers and wits with very modest fare, and twenty-dollar talk at table?

Locke's Beloved Vagabond lost all the facts of life, fame, money,

the woman; but who that has wandered across the pages of romance with him does not envy him the keen appreciation of life, the realization of its realities, the high and compelling ideal, even against the background of poverty-stricken and often drunken facts. Jean Christophe lived all but his musical life vicariously. The woman he loved was another man's loyal wife; his children were born from other men's passions; his home was wherever he could feel the universe. He lived without the material realizations of life; but who of us would not desert unconscious wealth, houses and homes for such a conscious life?

The poet Dante illustrates in his own life the relative value of facts and dreams, of living life directly and living it vicariously, to a singular degree. He was married and had a family of children, but in all his voluminous writings there is no word of these facts of his daily existence. In his early youth he fell in love with Beatrice; we know very little about her; she married another man; and it is quite probable that Dante never even touched her hand; but she led him through Paradise. Since the poet's death, millions have read and have been shaped by the "Vita Nuova" who have never even heard of the wife and children who were the facts of Dante's life.

If all this be true, then the modern woman who does not marry need not feel that life is closed to her, that having been denied the Garden of Realization she must stand before the gates and weep. When the angel with the flaming sword drove Eve out of Eden he opened the world of work and varied experience to her. Gifted with imagination and desire, she could create for herself new gardens of perfection; and if they were less real than those she had left, they were possibly more vividly realized than was the one where she had slumbered away the days of happiness.

Self-realization through vicarious living, this is the solution to a celibate life for the individual. Joan of Arc gave herself to religion and to her people. Madam Kovalevsky found at least relief for the letters that did not come in the honors that were lavished on her mathematical discoveries. Susan B. Anthony found her realization in the ideal life that was to come to all the women of the world; her sister, Mary Anthony, found a deep and rich realization in serving her better-known sister, who was to her all that home means to most women.

Thousands of our teachers are truer mothers to their children than are the mothers who bore them. In schools, libraries and social centers many fine women are to-day wedded to humanity; they are conceiving new ideals of social justice and are giving birth to opportunity for fuller living that shall bring conscious gladness to millions unborn.

For themselves and for all the higher purposes of civilization such lives may have great worth. Biologically they are lost; for the little

strand of the stream of life that finds lodgment in them ceases with their death. This is a pity; and it is a pity, too, that back of the dream there should not be also the reality. One can not help feeling that the children of Dante and Beatrice would have added something of great worth to the fact of existence.

And that this may come in the future we must remodel our medieval institution of marriage. It must cease to be a political convenience or a religious sacrament and must become a biological truth. We must make it impossible for the state to sanction and for the church to sanctify the marriage of imbeciles and of old men and young girls. Women must be emancipated socially, as they have been emancipated intellectually and economically; and they must be given a larger and more direct share in chosing their life mates. We must put family finances on a basis of equal partnership that will attract self-supporting and self-respecting women. We must provide ample opportunities for young people to meet and know each other and we must recognize the fact that it is always a sin for men and women to live in the close companionship of marriage if they do not love each other.

WAVE WORK ON THE NEW JERSEY COAST[1]

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DURING the winter of 1913–1914 three unusually severe storms with violent on-shore winds visited the coast of New Jersey. The first of these, known as "the Christmas storm," attained its maximum strength early on the morning of December 26, and was accompanied by winds which attained a velocity of 123 miles an hour. Professor W. M. Wilson gives the following brief description of this storm in the *Monthly Weather Review* for December, 1913.

> With 13 lives lost and millions of dollars of damage done to property, the terrific wind, rain, sleet and snow storm, which began Christmas night and swept over five states, abated early on the twenty-seventh, leaving a cold snap in its wake. The masters of the *A. C. Rose* and the *Undaunted*, coal barges, with eight seamen, lost their lives when the barges foundered off Forked River, New Jersey. Two men died of exposure and were found in roads near Trenton, New Jersey. A workman was drowned in the East River when his rowboat was swamped. The full force of the storm fell upon that portion of New Jersey which reaches out into the ocean like an elbow. Records at Long Branch show that the wind attained a velocity of 123 miles an hour, the highest ever recorded by the Weather Bureau at that point. Seabright, New Jersey, was the plaything of the ocean. Waves whipped by the gale tore away supposedly floodproof bulkheads, smashed bathhouses, washed away or undermined fishermen's cottages, tore away portions of two big summer hotels, inundated the main streets, and buried railroad tracks under 18 inches of sand, brick, and rock.

The second, or "New-Year's storm," was even more disastrous than the first, partly because the coast had been left in an unprotected condition by the preceding attack. On January 4 the fury of the second storm reached its maximum. Driven by a terrific gale whose extreme velocity reached 120 miles per hour, the waves broke upon the beach with a thunderous roar. Bulkheads which had been destroyed or weakened during the earlier storm afforded no protection for the unconsolidated sand of the beach, and every wave seemed to sweep a little of it out to sea. At Seabright groups of dejected men, soaked to the skin by driving rain and salt spray, stood helplessly by the shore and watched the waves remove the land from under their houses, the houses tip over into the sea, and the waves pound them to kindling wood in the space of a few moments. Others labored to place wooden rollers

[1] The substance of this article appears as part of Bulletin 12 of the Geological Survey of New Jersey.

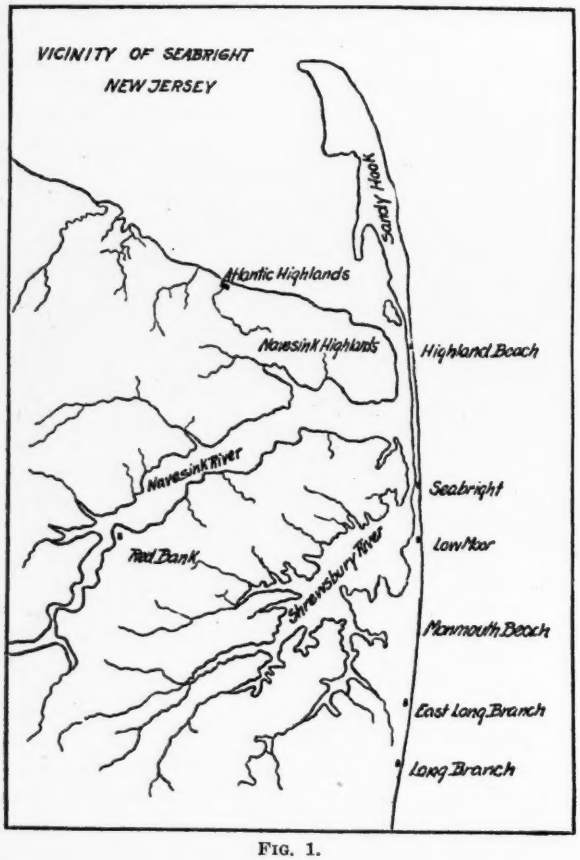

FIG. 1.

under some of the smaller cottages and drag them farther back upon the beach before the waves demolished them: while still others hurriedly removed their furniture in wagons, abandoning the buildings to their fate. A few men stood under the corner of a partially undermined summer residence and struggled in vain to erect a plank bulwark which would stop the advancing sea, while the surging waters nearly swept them from their feet. Crowds of spectators waded knee-deep through the foam blown up from the surf zone by the winds, and watched the water of the sea leap high above three-story dwellings where waves were breaking against some resisting bulkhead. Many observed with anxiety the attack of the sea upon the beach under the large Octagon Hotel, and shortly before noon saw the great building collapse and become, in a short time, a tangled mass of splintered wood rising and falling with the waves. Occasional waves sent water across the narrow bar, the streets of Seabright were inundated, and the unusually high tide which accompanied the storm kept many houses on the lower, back

FIG. 2. RUINS OF OCTAGON HOTEL AT SEABRIGHT.

part of the beach surrounded by water for hours. Fortunately, the waters were quiet in the protected bay, and the damage here was slight compared with that on the exposed outer shore, where for a couple of hours a large building collapsed on an average every fifteen minutes. North of Seabright the waves broke through the breakwater which protects the railroad, swept part of the tracks out to sea, and buried other portions under masses of heavy stones.

On February 14 and 15 occurred the third and least destructive storm of the series, when the wind reached an extreme velocity of 116 miles per hour. At this time the waves completed the destruction of the Seabright Beach Clubhouse and certain other structures badly damaged by the earlier storms. In the unprotected state of the shore some further damage has been subsequently accomplished by normal wave erosion during comparatively calm weather, at least one valuable summer residence being demolished in this manner.

The portion of the New Jersey coast which suffered most from the storm waves lies south of Sandy Hook and north of Long Branch. (See Fig. 1.) At the latter place the waves of the sea are attacking the mainland of New Jersey and have cut a marine cliff some 20 feet in height in the seaward edge of the coastal plain. The débris eroded from this cliff has been carried northward by longshore currents and built into a narrow bar which has extended across the mouth of Shrewsbury and Navesink Rivers, and out into the Bay of New York to form the Sandy Hook spit. Monmouth Beach, Seabright and Highland Beach are small towns built upon the bar, and are therefore but a few feet above high-tide level. Formerly the sea broke against the mainland just back of Seabright and at Navesink Highlands; and old marine

cliffs, now grass covered, may be seen at these points. But the bar now lies a short distance in front of these old cliffs, and protects them from erosion. Shrewsbury and Navesink Rivers are really bays of the ocean formed by a sinking of the land or a rising of the ocean level which permitted the seawater to flood pre-existing river valleys. They are "drowned valleys," but not "rivers" in the true sense of the term.

In order fully to appreciate the effects of storms upon the New Jersey coast, it is necessary to keep in mind some of the conditions affecting wave energy. The destructive power of a wave depends in part upon its size, and this in turn partly upon the water depth. Waves usually break and dissipate their energy when they come into water of a depth equal to the wave height. Hence, the deeper the water immediately at the shore the larger the waves which can attack it, and the greater the damage they will effect at that point. It follows from this that the rise of the tide must increase the destructive power of storm waves on the coast, not only because it brings the zone of wave activity farther in upon the shore, but also because the deepening of the water as the tide rises against the steeper upper part of the shore profile permits larger and more powerful waves to break against the shore cliffs. In all the recent storms the chief damage to the New Jersey coast occurred at the high-tide periods, and the citizens worked feverishly during low water to prepare for the violent wave attack which they knew would ensue at the next high tide.

On-shore winds increase the destructive power of the waves in a variety of ways. First of all, they raise the water level by blowing the surface of the sea along the coast faster than the water escapes seaward

FIG. 3. HOUSES BEING UNDERMINED FROM REAR.

FIG. 4. UNDERMINING OF SANDBAR CAUSING COLLAPSE OF HOUSE.

along the bottom as undertow. In the second place, on-shore winds, by driving the surface of the sea landward, insure a vigorous undertow seaward; this undertow carries the beach material out to deep water, thereby aiding beach destruction. Vigorous on-shore winds drive in large waves, whereas off-shore winds, no matter how violent, can not form large waves in the immediate vicinity of the shore. During the recent storms on-shore winds raised the high-tide level on the New Jersey coast from one to several feet above its normal elevation, much beach sand was sucked out to sea by the resulting undertow, and large waves were driven upon the shore with terrific violence.

Other things being equal, the greatest damage will occur where the land exposed to wave erosion is lowest. Waves may expend their energy in two ways: in eroding the land or sea-bottom, or in transporting débris. If the land is high, the waves break at the base of a high cliff which sheds much débris into the water as its base is undermined. This débris must be removed by the waves if effective erosion is to continue, as otherwise the cliff would soon be protected by the accumulated waste. Removal of the débris requires much of the waves' energy, and leaves them less competent to wear back the cliff. If the land is low, the low cliff sheds but a small amount of waste upon the shore, the waves quickly dispose of it and energetically continue their landward advance. It is true that the effect of cliff height may be more than offset by other factors, among which the form of the adjacent sea-bottom is important. Of still greater importance for such a region as the one in question is the effect of artificial sea defences, such as breakwaters, bulkheads and similar devices.' At Seabright and adjacent

towns the greater damage was suffered where the bar was lowest, or where the defenses were weakest. One of the lowest places on the bar was occupied by the Octagon Hotel, which was completely destroyed (Fig. 2). For a great distance along this low region the shore was cut back from 100 to 150 feet, and the damage to buildings was greater than elsewhere. Both north and south of Low Moor station are unusually high portions of the bar, and here the advance of the sea was not so great, even where the defences were battered down and the houses partially undermined. A maximum of not more than 50 to 70 feet of the shore front was cut away in this region, while the sea gained nothing from the land where the bulkheads remained intact. On the other hand, there are plenty of instances where unusually weak defences failed to prevent fairly extensive erosion of comparatively high areas, and where strong defences saved low areas from attack.

Variations in the character of the material composing a coast necessarily influence the wave erosion. In the Seabright district there is not enough of such variation in the material of the bar to be of any importance. The bar first formed some distance seaward of its present position, and has been pushed landward by the waves. A salt marsh formed back of the bar, and the sands of the latter have been driven in over the surface of the marsh deposits. Hence, the wave-cut cliff on the seaward edge of the bar shows at the base a layer of somewhat indurated black sand, mud and peat, projecting as a little terrace where recently exposed. Above this the yellow-brown beach sands constitute the rest of the cliff, which stands nearly or quite vertical where recently cut into. As these conditions appear to be essentially uniform along the length of the bar under discussion, there is little difference in

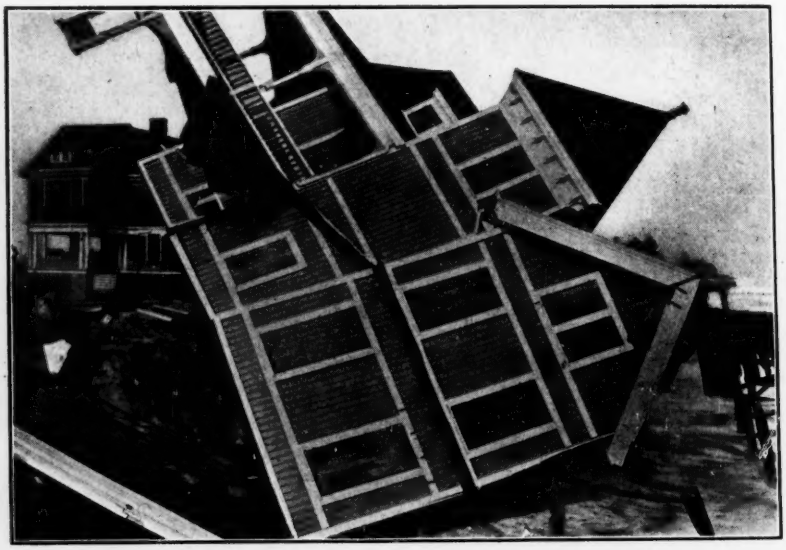

FIG. 5. HOUSE UNDERMINED BY WAVES AND TILTED BODILY INTO SEA.

the rate of erosion at different points which could be attributed to variations in resistance of materials.

An examination of the Seabright shore indicates that the greatest damage to bulkheads resulted from the direct impact of the waves, whereas the buildings suffered most from the undermining of the ground upon which they stood. When it is remembered that ocean waves strike a vertical face with a force of from a few hundred pounds to more than six thousand pounds per square foot, their enormous destructive power may readily be appreciated. Solid blocks of granite have been shattered by wave impact upon the coast of Holland, and it is therefore not surprising that the wooden bulkheads of the Jersey coast should yield to the attack of the sea wherever they were not reinforced by parallel rows of piling with heavy stone filling, or otherwise rendered especially strong. Fig. 7 shows one of the weaker bulkheads in the early stages of destruction.

Most of the bulkheads were surmounted by a broad boardwalk which served to shed falling wave crests back into the sea, and thus protected the cliff from erosion. The force generated by masses of water falling from the great height to which they are projected when a storm wave strikes a vertical wall, may be sufficient to crush such a boardwalk, even if supported by heavy timbers. During a severe gale at Buffalo, New York, many large timbers, 12×12 inches in thickness, 12 feet long, and 10 feet between supports, were broken like match sticks by the impact of falling water which had been hurled from 75 to 125 feet into the air by breaking waves. There are several localities in the Seabright district where the demolishing of the bulkheads had been hastened in this manner.

Many of the bulkheads are protected by rows of piling set some distance out in the sea to break the force of the oncoming waves. Even where the sea attack was powerless to break these pilings or to tear them from their positions, the waves passed between the pilings and still retained sufficient force to destroy the bulkheads which presented a more continuous surface to their impact. Fig. 6 shows such a series of protecting piling, which remained largely intact while the bulkhead immediately in front of the house was battered down and the house itself destroyed. Fig. 2 shows a series of pilings surmounted by undamaged bath-houses, back of which the shore has been so badly eroded that the superjacent houses have collapsed.

As a rule, the houses were not damaged as much by direct wave impact as by the undermining of the beach upon which they stood. It is of course true that a building from under which most of the support was already removed by the sapping action of the waves, often received its "death blow" from some extra-large wave; and a building which was once tipped over into the edge of the sea as a result of being undermined was soon pounded to pieces by the waves. The Octagon Hotel

FIG. 6. FIRST STAGE OF WAVE ATTACK ON PROTECTED HOUSE.

FIG. 7. BREACHING OF BULKHEAD AND BEGINNING OF UNDERMINING. Same house as in Fig. 6.

FIG. 8. SANDY FOUNDATION ALMOST WHOLLY REMOVED BY WAVE EROSION. Same house as in Fig. 7.

FIG. 9. LAST STAGE OF WAVE ATTACK ON HOUSE SHOWN IN THREE PRECEDING FIGURES.

(Fig. 2) located on an unusually low part of the bar, is said to have collapsed bodily under the blow of one very large wave; while the house shown in Fig. 5 was consumed more gradually after undermining had allowed it to tip over. Indeed, the real damage was usually accomplished independently of direct impact upon the structures themselves. Even where the beach was low and flat, as near the Octagon Hotel in the town of Seabright, the foundations were sapped from under dwellings, allowing them to tip over toward the sea; seldom if ever were these houses crushed in the first instance by the direct impact of the waves. This is clearly shown in the case of the small houses of Fig. 3, which were but a short distance from the hotel, and it is probable that the hotel itself was first weakened by the undermining process. In some cases the houses collapsed piecemeal as the sea advanced under them; or were crushed by the fall when they tipped over into the sea.

Where houses were built on pilings driven into the beach sand the removal of the sand left the buildings precariously supported on the pilings alone until shaken down by the moderate waves of some later storm. The successive stages of this process are well illustrated in Figs. 6–9, which represent four photographs of the same house. In Fig. 6 a small wave has passed through the outlying line of protecting piling and is breaking against the bulkhead built to preserve the house from destruction. Fig. 7 shows that the bulkhead has been breached and that the corner of the house is beginning to be undermined. The next figure represents a still later stage, when the sand has been removed from under most of the house, leaving it supported by the pilings alone. In this condition it fell an easy prey to the smaller waves of later storms, and Fig. 9 shows the final wreck of the building.

One reason for the destructiveness of the undermining action as compared with the direct wave attack is to be found in the fact that lines of piling and bulkheads were together able to break the force of the waves to a large extent, but could not prevent the water of each wave from washing against the foot of the low cliff, removing part of the sand, and carrying it back to sea. In many places the lines of piling, and even the bulkheads, are still in a state of partial preservation, while the cliff back of them is badly eroded and the superjacent houses completely destroyed. The fact that the houses were at a higher level than the cliffed beach was, of course, another factor which rendered direct wave impact less destructive than undermining.

Some have supposed that the active erosion of the New Jersey coast by storm waves is the natural consequence of the gradual subsidence of that coast which has been inferred by some geologists. The evidence for and against the theory of subsidence has been considered by the senior author in various publications, and need not be repeated here. Suffice it to say that the loss of land during the recent storms represents exceptionally rapid erosion of a purely temporary character,

due to an unusual disturbance of the profile of equilibrium by exceptional storms. Most of the material removed from the bar was carried seaward to perfect the proper shore profile of equilibrium demanded by the storms. Part of it, at least, should be carried back to the beach as new conditions demand a new profile. In fact, this process is already in operation, and the shore has been built so far forward in places as to obscure much of the erosive effect accomplished a few months ago. Nothing in the nature of the erosion or of the deposition indicates any change in the relative level of land and sea.

If the land were sinking at the rate of one or two feet per century, the problem of maintaining sea defenses against the ravages of the ocean in the Seabright district would be more serious than it is. The tendency of storm waves to cut into the land would be more marked than at present, and the tendency of marine forces to repair the damage by deposition during calm weather would be less evident. Even as it is the problem is sufficiently serious. Along with the alternate erosion and accretion in the shore zone, due to the varying effect of the marine forces, there is a slow loss of land resulting from the action of currents in transporting some of the eroded debris to deep, quiet waters farther out to sea. This loss can only be arrested by superior methods of artificial protection.

That the damage of which the sea is capable justifies the expenditure of large sums of money in improved sea defences is abundantly proved by the recent storms. The actual value of property completely destroyed in the single town of Seabright was enormous and the suffering of its citizens can not be estimated in money. Many who were unable to bear any loss saw the savings of a lifetime swept out to sea by the merciless waves. It would be difficult to estimate the depreciation in the value of property along this part of the coast alone, a depreciation shared by lands not actually eroded because of the apparent magnitude of the dangers to which they are subjected.

So long as the defence of the land is in a large number of hands and every landowner is practically free to do as little or as much as he pleases toward preventing the sea from gaining access to his property, many must suffer from the failure of a few to take proper precautions against marine erosion. As soon as the sea finds a point of weakness in the defences, it rapidly widens the breach and attacks adjoining property on either side. In some places where the bulkheads in front of one man's property resisted the direct attack, the property was badly damaged by erosion from one or both sides after the sea had entered neighboring lots. Some method of government supervision of marine defences would seem to be the only satisfactory solution of this serious problem.

FERTILIZATION AND ARTIFICIAL PARTHENOGENESIS OF THE EGG

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TICHOMIROFF, in 1886, was the first to use the term artificial parthenogenesis, referring to acceleration in the development of the naturally parthenogenetic eggs of the silkworm by methods found effective in hastening development in fertilized eggs of the same species. To-day the term is applied to development of eggs not usually parthenogenetic, although a few such might develop in nature under accidentally abnormal conditions.

The exact extent of development that is to be dignified by this term is a matter of dispute, some claiming it should be possible to produce an adult reproductive organism by artificial parthenogenesis. Though Delage obtained two sea urchins in this manner and more than one observer has so produced frogs, none of these reproduced a second generation, a fact not hard to understand on remembering that normally fertilized eggs of many animals have never been reared to maturity and reproductive activity under observation. Loeb considers a swimming larva to be the goal of the investigator. But it is interesting to note that the "swimming larvæ" of the marine worm *Chætopterus,* which he produced from unfertilized eggs, were shown by F. Lillie to be abnormal, unsegmented or poorly segmented eggs that had developed cilia.

We may consider for a moment what signifies development in the egg. The egg of any animal is in the beginning a single cell and undergoes a certain development before normal fertilization. Some animals reproduce parthenogenetically for several generations (*i. e.,* plant lice) and the silkworm eggs, noted before, undergo more or less development if fertilization fails to occur. The eggs of most animals, however, do not segment (produce an embryo) before fertilization. Though in many of these same species (for example, sea urchin) the eggs (during maturation) undergo before fertilization two very unequal cell divisions, resulting in the formation of "polar bodies," the unfertilized egg is generally considered a single cell, since the "polar bodies" seem to have no further part in the formation of the embryo. The positive sign of development in the mature egg seems to be segmentation. We may therefore consider artificial parthenogenesis to be demonstrated by the segmentation of unfertilized eggs which do not normally segment until fertilized.

R. Hertwig was the first to observe the segmentation of unfertilized

sea-urchin eggs, which normally die if not fertilized. Morgan, in 1899, produced segmentation in unfertilized sea-urchin (*Arbacia*) eggs, by immersing them in sea water to which a dry salt had been added, such a solution being called hypertonic sea water, and having a greater osmotic pressure than ordinary sea water. Loeb, immediately afterwards, produced swimming larvæ in sea water made hypertonic by the addition of magnesium chloride. Since then many investigators have studied the subject. Eggs of various animals have been made parthenogenetic by putting them in solutions containing salts, acids or alkalis, sugar, fat solvents, blood sera, alkaloids, or by means of asphyxiation, or by mechanical, thermal or electric changes. The concentration of the solution in which the eggs are treated may be the same as that of the fluid in which they normally live, or it may be of a greater or less concentration.

It has been fairly well demonstrated that the artificial agents—used in producing parthenogenesis—act primarily on the surface of the egg, and R. Lillie supposes they tend to increase its permeability. Loeb recognizes a "superficial cytolysis," the exact nature of which is, however, unknown. When cells containing soluble coloring matters undergo cytolysis, the colored substances come out of the cells. Cytolysis has, therefore, been considered to consist of, or be accompanied by, an increase in permeability of the protoplasm.

The electric conductivity method of Kohlrausch suggested itself to the writer as the best way of settling this question of the permeability of the egg. The principle of the method lies in the fact that an electric current is carried through wet substances by the movement of electrically charged atoms or "ions." If the permeability increases, the ions move faster and the current is greater. The use of this method showed that the permeability increased immediately after fertilization, on the application of agents producing parthenogenesis.[1] These results were confirmed by Gray,[2] who observed further that the permeability decreased again about fifteen minutes after fertilization. Lyon and Shackell[3] observed that the permeability of the egg to certain dyes increased on fertilization, and also that more of the red substances came out of the fertilized than out of the unfertilized eggs. E. N. Harvey observed independently that the permeability of the eggs to certain dyes and caustic soda increased on fertilization. Finally, Glaser has recently concluded from his experiments that fertilization increases the egg's permeability.

There is another proof that the egg of one species (the frog) becomes more permeable to salt on beginning development. The writer

[1] McClendon, *Am. Jour. Physiol.*, 1910, 27, 240.

[2] J. Gray, *Jour. Marine Bio. Assn. United Kingdom*, 1913, X., 50.

[3] *Science*, 1910, 32, 249.

observed that the frog's egg may be made parthenogenetic by means of a momentary electric shock. Unfertilized eggs of a frog were divided into two equal lots, placed in distilled water, and one lot shocked electrically. It was found that three times as much salt diffused out of the shocked eggs as out of the control. Since the salt must have come from the interior of the eggs, the experiment seems to prove that the eggs must have been permeable to it. The shocked eggs began to segment and behaved in other ways as if normally fertilized.

There seems to be no doubt that the permeability of the egg is increased by agents producing parthenogenesis, but just how this influences the egg's development is not absolutely settled, because of the many processes in development which are very far from being solved. Some of these processes have been the subject of numerous investigations. The outward change in form during the segmentation of the egg is caused by changes in surface tension. Granted that fertilization alters the permeability of the egg, it may be that the changes in permeability influence the surface tension.[4]

The unfertilized eggs of sea urchins, frogs and many other animals are surrounded by jelly-like coats, the inner layer of which lies close to the egg. On fertilization, the jelly is pushed out by the perivitelline fluid exuding from the egg, the space occupied by the fluid being called the perivitelline space. The inner layer of the jelly looks like a distinct membrane and is called the "fertilization membrane." Loeb considers its formation of great importance. Biataszewicz has shown that the frog's egg shrinks as this fluid is "secreted." Glaser has observed the same phenomenon in the sea urchin's egg, though the shrinkage is so slight that other observers deny its taking place. Granting that the perivitelline fluid comes from the egg, the increase in permeability would facilitate its migration.

If the jelly be removed from the sea urchin's egg prior to fertilization, no "fertilization membrane" appears. Presumably the fluid is secreted but lost in the surrounding water.[5] Though the membrane helps to protect the embryo, its existence is not absolutely essential, since eggs lacking it (due to the removal of the jelly) have been known to develop. Many observations and experiments have demonstrated to the writer that the tough "fertilization membrane" of the sea-urchin's egg does not exist (at least in its final condition) before fertilization. The increase in permeability allows the escape of the perivitelline fluid which, according to the hypothesis advanced in 1911, interacts with the jelly and forms the "fertilization membrane."[6] Elder, in 1913, came

[4] McClendon, *Roux's Archiv*, 1913, 37, 233.

[5] McClendon, "On the Nature and Formation of the Fertilization Membrane," *Internat. Zeit. f. Physik.-Chem. Biologie*, 1914, Vol. 163.

[6] McClendon, *Science*, 1912, 33, 387.

to hold the same view. E. N. Harvey, though believing that the membrane is not present before fertilization, considers the jelly unnecessary for its formation, holding that the membrane substance hardens on contact with sea water. He admits that unfertilized eggs from which the jelly is removed soon lose their power of forming membranes on fertilization, but says they do not lose it immediately. Perhaps he left a thin film of jelly adhering to the eggs or had not removed the water containing the dissolved jelly. This dissolved jelly may be in time decomposed by bacteria and thus prevent membrane formation. If eggs with jelly remain in sea water fifty-two hours, they do not form membranes on fertilization.

When a sea urchin's egg is fertilized, an increase in the rate of respiration occurs, as shown by O. Warburg. This may be due to some physical change, and is to be expected, since the egg passes from a state of inactivity to one of activity. When the starfish egg is liberated from the body of the female into the sea, it becomes active to the extent of extruding the polar bodies. Loeb and Wasteneys found that respiration was high at the time of formation of the polar bodies in the starfish egg, and continued about the same level, whether fertilized or not. The egg may pass through an inactive stage while in the ovary, with corresponding low respiration. Coming in contact with sea water may stimulate it toward development, with resulting maturation and increased respiration, though the stimulus is not sufficient to cause segmentation. This is in harmony with the fact that much weaker stimuli cause segmentation in starfish than are required by sea urchin eggs. The frog's egg resembles the former and Batallion has shown that the slight prick of a needle is sufficient to cause the frog's egg to segment, while needles have been thrust by the writer all the way through sea urchin's eggs without causing either segmentation or death.

O. Warburg has shown that the respiration of all developing eggs is high, regardless of the methods used to cause segmentation. Respiration is therefore essential to development. Cleavage once started may be slowed or stopped entirely without materially decreasing respiration, indicating that respiration is not a result of cleavage. In order to discuss the relation of respiration to development, it is necessary to go more into detail on the general question of respiration.

Oxidation or Cell Respiration

As is well known, the heat of a flame is unnecessary for the burning (oxidation) of many substances. For example, coal oxidizes slowly in the air, decreasing in weight, a fact which has led to efforts to preserve its fuel value by keeping it under water. Naturally, even slow combustion generates heat, and if the heat be confined, results in spontaneous combustion, *i. e.*, the raising of the temperature to the flame point.

Many substances burned in the body—sugar, for example—may undergo slow oxidation in alkaline solution in the presence of atmospheric oxygen (O_2). In the body, however, it is burned at a faster rate, leading to the conclusion that some other substance or substances are necessary. The search for such substances has led to the discovery of so called oxidizing enzymes, which oxidize many organic substances. It is characteristic of an enzyme, however, that it accelerates but one reaction. For the complete oxidation of grape sugar, for instance, it is supposed that a series of enzymes is necessary. This must remain for some time a supposition, as no pure substance or mixture of soluble substances has been extracted from the body that will completely oxidize grape sugar.

It might be concluded that "life" is essential to such oxidations, but such is not the case. In some instances ground up tissue, free from entire cells, absorbs oxygen and gives out CO_2 at a rapid rate. It is evident that some substances are completely oxidized in the process. The question has been raised as to whether the cell structure which has not been completely destroyed in grinding the tissue be necessary for the oxidation. In certain experiments Harden and McLean failed to observe respiration in juice pressed out of muscles and other tissues. Warburg and Meyerhof ground nucleated red-blood corpuscles with sand, finding that the mass did not absorb oxygen or give out CO_2, whereas the original cells did. Warburg tried to destroy the structure completely by grinding corpuscles in a steel box; with steel spheres rotating at such high speed it was found necessary to cool the box with ice in order to prevent injury to the corpuscles by heat (Barnard & Hewlett apparatus). All microscopic structure was destroyed and respiration ceased.

In other experiments, Warburg ground up liver cells, passing the juice through a Berkefeld filter. The respiration of the juice was but five per cent. of that of the corresponding amount of liver cells. But when a coarser filter was used which allowed the passage of cell granules, the oxidation was found to increase to twenty per cent. of that of intact cells.

If blood corpuscles be placed in water, or in certain solutions, the hemoglobin passes out of them, they become pale and are called "ghosts." This liberation of the hemoglobin, known as "laking," is a kind of cytolysis. Warburg laked nucleated red-blood corpuscles of a goose, finding that respiration continued in the "ghosts," but did not occur in the fluid procured by laking.

Such experiments seem to show that the presence of solid structures, granules, etc., accelerates the respiration, since no substances were eliminated in the process of grinding. It is possible that the solid structures act in the same way, as does finely divided platinum (called platinum

black), which accelerates certain chemical reactions by the condensation of the reacting substances on the surface of the platinum, and their consequent increase in concentration. This process of condensation on surfaces is called adsorption. Warburg supposes that the oxidizing enzymes, oxidizable substances and oxygen are condensed on "surfaces," thus causing the oxidation rate to increase, but what surfaces he means it is difficult to determine, in some places apparently referring to surfaces of granules or colloidal particles, in others to cell or nuclear surfaces.

The adsorption of easily adsorbed substances may retard or prevent entirely the adsorption of others less readily adsorbed. Warburg found that anesthetics reduced the respiration of a mass of cell granules, presumably by driving the enzymes or oxidizable substances from their surfaces. He further observed that animal charcoal in water oxidized oxalic acid to CO_2, whereas if anesthetics were added the oxidation was reduced.

Warburg and Meyerhof found that the respiration of sea-urchins' eggs was not entirely destroyed by grinding with sand, presumably because the cell granules were left intact. They explain it, however, as an auto-oxidation or spontaneous oxidation of lecithin in the presence of iron salts, the oxidation taking place in the test tube. Warburg found iron and lecithin in the sea-urchin eggs and observed that if the total lecithin that could be extracted from a mass of eggs were mixed with a dilute solution of iron chloride, the oxidation was as great as that of the mass of ground cells. From his data we conclude that the mass of ground unfertilized eggs undergoes the same oxidation as does the same mass of cells if it were fertilized before grinding. Warburg interprets this as indicating that the oxidation of unfertilized eggs is due to auto-oxidation of lecithin, and that the increase in oxidation on fertilization is due to increase in structure (surfaces). Since mechanical agitations, however, may cause the eggs to develop, it is possible that the grinding first stimulated each egg to as great respiration as that of a fertilized egg, but the crushing and subsequent mixing of substances reduced the oxidation. It is interesting to note that, whereas unfertilized as well as fertilized eggs absorb oxygen and give off CO_2, ground eggs or lecithin and iron mixtures do not give off CO_2, indicating oxidation is not complete.

Relation of Oxidation to Permeability

R. Lillie supposed the oxidation within the unfertilized eggs to be suppressed by an accumulation of some end product of oxidation that could not escape. It is possible that such a substance might act like an anesthetic and suppress oxidation by adsorption to the granules. Lillie supposed this substance to be carbonic acid, but this is hard to

believe when we bear in mind that the egg may be caused to develop by short exposure to carbonic acid. On fertilization this hypothetical substance would be liberated and could be collected. Glaser fertilized quantities of eggs in a small amount of sea water. On using the same water in which to develop other fertilized eggs, he found it inhibited their development, indicating the presence of an inhibiting substance that came out of the first eggs on fertilization. (Was this CO_2?)

Loeb's "improved method of artificial parthenogenesis" claims two treatments of the eggs to be necessary. They are first to be stimulated to development by use of fatty acid, or some other method, and then exposed to a hypertonic solution. The latter he calls a "corrective agent" and supposes that it changes the character of the oxidation in the egg, since he observes no effect on the rate of oxidation in the developing eggs. It is hard to conceive of such a change in "character," since oxidation means union with oxygen and there is but one kind of oxygen atom in combinations. The oxygen might attack different substances, but in such cases different amounts of heat would be given off, the heat of combustion of fats and carbohydrates, for instance, differing in amount. Meyerhof showed that the ratio of oxygen used to heat produced was the same for eggs in the hypertonic solution as in sea water. When we consider that by the use of either fatty acid or hypertonic solution alone, sea-urchin (*Arbacia*) eggs may be made to develop, it seems unnecessary to devote more time to their combined effect.

Relation of Anesthesia to Development of the Egg

Anesthetics have a depressant action on various cell activities when used in certain concentration. They decrease the respiration and rate of cleavage of sea-urchin eggs (and asphyxiation will cause cleavage to cease). It may therefore be supposed that it is the suppression of oxidation by anesthetics that suppresses cleavage. Warburg, however, caused the almost complete cessation of cleavage in sea-urchin eggs with anesthetics without appreciably lowering the respiration. It may be that the anesthetic acts in one part of the cell (on the surface of the granules) in suppressing oxidation, and in another (on the cell surface) in suppressing cleavage.

In 1909, while measuring the electric conductivity of sea urchins' eggs, the writer observed the decrease in conductivity on the addition of a certain per cent. of chloroform. This experiment was not repeated, but we may imagine that the chloroform decreased the permeability of the eggs to ions. Osterhout, becoming interested in the methods used, modified them for use with plants, and observed a decrease in electric conductivity of certain plants (kelp) when using a certain concentration of anesthetic, indicating that the anesthetic decreased permeability. R. Lillie found that anesthetics might antagonize the action of the pure

salt solutions used to cause eggs to develop, presumably preventing the increase in permeability usually caused by the salt solution.

The use of fish eggs in settling this question presented itself to the writer. It was found that the eggs of the pike will develop in distilled water and are practically impermeable to salts—that is to say, that the salts which they contain diffuse out of them only in such small quantities as to render detection almost impossible even with as sensitive an instrument as the nephelometer. It was found, further, that pure solutions of sodium nitrate increased the permeability of the eggs to chlorides (since the chlorides diffused rapidly from the eggs). The use of anesthetics prevented the effect of nitrates on the permeability of the eggs, so that the chlorides failed to diffuse.[7]

It is thus evident that the problem of parthenogenesis is closely interwoven with fundamental problems of physiology—stimulation, oxidation and anesthesia; and that the final elucidation of parthenogenesis and fertilization must wait on the solution of these other problems. On the other hand, the systematic study of parthenogenesis has already shed much light on general physiology, and progress will be more certain if all of these problems be kept before the mind of the investigator.

[7] *Science*, 1914, Vol. 40, p. 214.

THE OHIO PLAN FOR THE STUDY OF DELINQUENCY

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BY the careful study of the problems of human heredity in the last few years, eugenic workers have brought about a more general appreciation of the tremendous burden and waste brought about by the propagation of misfits. It is generally accepted that the principles of breeding, which hold for Guernsey cattle and navel oranges, hold also for human beings—that social misfits reproduce their defects quite as certainly as do long-haired guinea-pigs and corn grains, rich in starch content, reproduce their respective qualities. Mendel's Law is valid for all living forms. Furthermore, high-grade defectives are very prolific. Restraints, which affect the numbers of children borne by normal mothers, have no effect upon the amount of progeny of the feeble-minded, so they tend to reproduce much faster than the normal persons around them. It is therefore self-evident that society must impose artificial restraints, for its own safeguarding.

1. The first suggestion, which occurs to every one, is to segregate the misfit and thus prevent propagation. With the estimates of the numbers of defectives, it is quite impossible to provide asylums, schools and custodial farms for all defectives. Such institutions as are provided by states and private munificence are everywhere overcrowded and holding long waiting lists, while normal children in the public schools are hindered in their education by the presence in their classes of feeble-minded children. It is much too great a burden for society to undertake the lifelong segregation of all the feeble-minded. Furthermore, it is not an intelligent procedure, until we are better informed as to different sorts of defect, and their respective viabilities in the stocks.

2. Again, sterilization has been proposed as a panacea for this social ill—the threatened enormous increase of the feeble-minded. But this is by no means a solution of the problem. Sterilization would certainly stop the breeding of the sterilized, but the consequences of known immunity from conception through salpingectomy of the female or vasectomy of the male, would lead to much increase of immorality and spread of venereal diseases. Such operations do not remove sex feelings for a considerable period of time.

Twelve states have passed sterilization acts. Seven of these specifically provided for the sterilization of the mentally defective; three others, of inmates of state hospitals, reformatories and prisons; and two, of habitual criminals and persons guilty of abuse of girls under ten

years of age. The law has been declared unconstitutional in one state. Public opinion is by no means ready for such treatment, even of the confirmed criminal or very dangerous imbecile. And it is quite out of the question to get sterilization enforced in cases of high-grade defectives. These are often attractive, and do not seem to be defective to casual observers. They are, however, most fertile sources of burdens to the state.

3. For delinquent minors, most states have provided reform schools and homes. At these schools, industrial education is emphasized, and this, with able field officers, is depended upon for turning these social misfits into useful law-abiding citizens. A very fine service has been rendered by these institutions. Many successes decorate their annals. It is, however, recognized that the institutionalizing of many boys and girls is a positive damage to their characters. Some acquire many anti-social habits and traits therein.

Most important in regard to the organization and work of these institutions is the question of mental deficiency in the delinquent. The high-grade defective has not been commonly recognized, and we now know that many such are and have been in these reform schools, and the officers of such institutions have entertained hopes of eliminating further delinquencies through education. But the education of defectives is a very special process, and it is well known that no education can overcome the defect in the native endowment of the individual.[1]

If, therefore, the delinquency is directly chargeable to the defect, the optimism and the procedure alike are ill founded. In so far, the state is misdirecting her energies, and wasting her funds. It is wise, therefore, to ascertain in the case of each delinquent, whether or not he is educable, and if so, in what direction and how far. Of course, practical psychology is far from giving us specific answers to these questions. But, we can ascertain whether or not there is definite feeble-mindedness in any given case, and the search for better answers to the above questions is a line of activity wherein research should save the state both money and citizens. The two classes, defective delinquents and delinquents in which no defect can be found, require different treatment. It is unfair to both to keep them together in one institution.

4. Another and newer agency dealing with juvenile delinquency is the Juvenile Court. The first of these was provided for in Chicago in 1899. There can be no doubt as to the value of this court with its probation system and social workers. They have saved many a child from a life of crime. It is a much saner system than its predecessor for supplying intelligence and authority to the management of children with whom the home is unable to cope. The older plan was that of the

[1] For statistics concerning extent of feeble-mindedness among delinquents, see H. H. Goddard, "Feeble-Mindedness," 1914, p. 9.

regular police and common pleas courts. It is, however, most important for these Juvenile Court officers to know whether or not the so-called badness of the child is due to defect, and in what direction and to what extent he may be educated for useful citizenship.

The question of defect, therefore, is looming large in the whole field of delinquency. In order to economize effort at reform, and at the same time make the greatest social salvage possible from these threatening wrecks of lives, we must know what is reformable. Clear defectives can not be trained into responsible citizens. They must have the education, which will bring them the greatest amount of happiness and make them as nearly self-supporting as possible, but they are not to be expected to become self-directive. They must be directed, and they must be prevented from propagating their defects.

There are cases of delinquency in which experts will agree that there is deficiency of the moral or social organization, while no definite defect in intelligence can be made out. There is defect in the organization of the self, and in the power of self-control. This defect is inherent also, and can not be remedied by education. This class of cases, some are classifying with defective delinquents. They are close to what have been called psychopathic personalities and cases of moral insanity. The defect is, of course, more difficult to define than a definite intelligence defect. It is also less certain that it is congenital and nonrecoverable. For these reasons, attempts to reform, through most skillfully guided education, should be made. This is the class for our reform schools. No clear defectives should be sent thither.

There are other delinquents coming to probation officers, and some to reform schools, who are in no sense defective. They are purely the product of mismanagement or lack of management. They are delinquent because society has not socialized them, and not through any lack of capacity to become socialized. These should never be sent to institutions. They need good home environments.

The large economic problem of delinquency has thus defined itself. No one can doubt the economic importance of making investigations into the causes of delinquency in each case, and the application of psychology and sociology to whatever extent possible in every case. Many cases are clear-cut. The relatively untrained person knows this one to be feeble-minded, and that one to be purely the product of a bad environment. But the doubtful group, a large one, demands expert talent for investigation.

Another field of research, and closely akin, is immediately suggested to the alert student of these problems. It is not only the scientific handling of the individual delinquent, so as to make the most social salvage of him, and save society the expense of supporting him, if possible. It is much more important to stop this social waste—this

production of misfits, at its sources. We need a social survey of large bodies of our population, so as to map out the tainted stocks. Such a thoroughgoing study of kakogenics in the territory of a given state would enable that state to develop principles to guide in the practise of breeding out these bad strains. All agree they are just as dangerous and expensive as smallpox, typhoid or tuberculosis, and that we should proceed by equally radical measures for the extermination of such strains as are used to rid communities of these diseases.

This view of the problems involved in delinquency, through the insight and persistency of Dr. E. J. Emerick, superintendent of the Ohio Institution for Feeble-Minded, and of Dr. A. F. Shepard, member of the Ohio Board of Administration, secured legislation during the winter of 1912–1913, providing for the establishment of a Bureau of Juvenile Research, July 1, 1914. The provisions of the statute are as follows:

Section 1841—1.—All minors, who in the judgment of the juvenile court require state institutional care and guardianship, shall be wards of the state and shall be committed to the care and custody of the "The Ohio Board of Administration," which board thereupon becomes vested with the sole and exclusive guardianship of such minors.

Section 1841—2.—"The Ohio Board of Administration" shall provide and maintain a "Bureau of Juvenile Research" and shall employ competent persons to have charge of such bureau and to conduct investigations.

Section 1841—3.—"The Ohio Board of Administration" may assign the children committed to its guardianship to the "Bureau of Juvenile Research" for the purpose of mental, physical and other examination, inquiry or treatment for such period of time as such board may deem necessary. Such board may cause any minor in its custody to be removed thereto for observation and a complete report of every such observation shall be made in writing, and shall include a record of observation, treatment, medical history, and a recommendation for future treatment, custody, and maintainence. "The Ohio Board of Administration" or its duly authorized representatives shall then assign the child to a suitable state institution or place it in a family under such rules and regulations as may be adopted.

Section 1841—4.—Any minor having been committed to any state institution may be transferred by such "The Ohio Board of Administration," to any other state institution, whenever it shall appear that such minor by reason of its delinquency, neglect, insanity, dependency, epilepsy, feeble-mindedness, or crippled condition or deformity, ought to be in another institution. Such board before making transfer shall make a minute of the order for such transfer and the reason therefore, upon its record, and shall send a certified copy at least seven days prior to such transfer, to the person shown by its records to have had the care or custody of such minor immediately prior to its commitment, provided that, except as otherwise provided by law, no person shall be transferred from a benevolent to a penal instution.

Section 1841—5.—"The Ohio Board of Administration" may receive any minor for observation from any public institution, other than a state institution, or from any private charitable institution, or person having legal custody thereof, upon such terms as such board may deem proper.

Section 1841—6.—Each county shall bear all the expenses incident to the transportation of each child from such county to such "Bureau of Juvenile Research," together with such fees and costs as are allowed by law in similar cases, which fees, costs and expenses shall be paid from the county treasury upon itemized vouchers, certified to by the judge of the juvenile court.

Section 1841—7.—The provisions of this act shall become valid on and after the first day of July, 1914.

It is thus seen that Ohio plans through the "Bureau of Juvenile Research," to study the problems of delinquency from the points of view of the best technology afforded by sociology, psychology and the biologic sciences. The law contemplates in this bureau a great laboratory for the study of vital phenomena—of sociologic material in the widest sense. The records of observations and examinations upon children, in the first place, will be expected to enable the authorities to deal with each child much more intelligently than they have been able to do heretofore. The reasonable expectations in regard to education will be set forth clearly in each case. Futile efforts to overcome native defect will be avoided. Doubtful cases of defective delinquents will be given experimental treatment in reform schools, till they are proved to be unimprovable or are improved. The non-defective delinquents will be saved from institutionalization, which will result in great economy both to the individual and to society.

There will result a new conception of the work of our reform schools, and also a new conception of the work of its field officers. The reform school is not to be expected to overcome native defect, but it is to be an experiment station trying out doubtful cases, ascertaining what retardations may be overcome. The field officer is to be a very highly trained practical sociologist, skilled in all the arts of guiding into proper lines the forces of socialization. His is to be the art of making personalities.

The lines of work undertaken in such technological studies are sure to result in new conceptions and divisions of feeble-mindedness. They are also likely to bring new visions as to the relations of intelligence to the will and emotions—the relations of knowledge to the springs of action and conduct.

It is also reasonable to expect that the clinic with its constantly flowing stream of delinquents, and the archives resulting from exhaustive physical, mental and social examinations made in the clinic and in the field will become a great museum for research into the kakogenics of the state. Society is not ready to demand eugenic marriages, but the accumulation of such material as this Bureau of Juvenile Research is making constitutes a most intelligent procedure to prepare us to control and to eliminate the propagation of the unfit. These investigations will also make contributions to pure science in psychology, sociology and biology.

SCIENCE AND HISTORY

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THE question has been a good deal discussed whether history is a science or an art. Those who deny to it a place among the sciences proceed on the assumption that science deals only with facts, with uncontrovertible truths, and as history is for the most part founded on the preponderance of probabilities, it should not be ranked as a science. It is not possible to frame a definition of science sufficiently comprehensive to embrace all subjects that may be investigated by man. Only a single branch of science deals with incontrovertible truths, that is mathematics, while the subject matter of all others is constituted of data and not of facts. Science is founded upon method rather than upon results. All the sciences that deal with forces which may be more or less modified by acts dependent upon the human will, such as economics, politics, ethics, and others of the same class, can never attain positive results. Besides, some of the sciences are constituted of forces that are latent and more or less inscrutable so that there is no possibility of predicting when they will become active. Comte placed geology among the histories. It is the discovery of the changes that have taken place in the composition and recomposition of the globe. While there is substantial agreement among experts as to the order in which these changes took place, there are many minor points upon which there is more or less divergence of opinion. When we endeavor to set forth the order in which events took place we produce history, even though the artistic element be entirely lacking. History, as the term is usually understood, is the interpretation, from written records, of the psychic forces as manifested in acts and institutions. By *written* we are, however, to understand all the devices which men have employed for the purpose of preserving the memory of their deeds to future generations. William James defined history "as the observation of a series of changes of conditions that never exactly repeat themselves and that ever tend toward further and unfathomable changes."

According to this definition everything in the universe that is capable of being intellectually apprehended and is not static may be dealt with historically. The discovery and investigation of the memorials that man has unintentionally left of himself are usually classed as prehistory, and include paleontology, anthropology and some other sciences.

The term *history* is used interchangeably in one of two senses, although they differ widely. Can there be a history where there is no

record, or only a very incomplete one? If we say, the French character is the product of French history, we mean one thing; if we say, M. Martin wrote a French history or a history of the French, we mean something quite different. This distinction is rarely observed with care.

All knowledge, every fact as distinguished from opinion or belief, may be classed under the head of science; at any rate, it is difficult to distinguish between them. There is a great deal of knowledge not intellectually apprehended that is the result of experience or of instinct. We are wont to employ the latter term to designate a capacity which we can not further analyze. Most quadrupeds when thrown into deep water swim as readily the first time as the twentieth, while man can not swim until he has learned. We know that quadrupeds can swim, but it is a question whether they know it. Is it proper to apply the term *knowledge* to what is known without having been learned? Most men as well as other animals learn by experience; the latter only to a limited extent however. The most important discovery ever made by man was the use of fire. How he made it we do not know. The Greek myth of Prometheus, who is reputed to have stolen it from heaven, points to a celestial origin, that is to a stroke of lightning. How highly fire was prized in ancient times is demonstrated by the veneration accorded to the Vestal virgins. They represented the last remnant of paganism to give way before the advance of christianity. Herodotus relates that the sole surviver of the Lacedæmonians at the battle of Thermopylæ was so disgraced that "no Spartan would give him a light to kindle his fire." In pioneer times the housewife was usually careful to keep the fire on the hearth from going out in the summer when it was not needed for warmth. In this respect civilized people usually exhibit less ingenuity than savages. The practical use that could be made of fire was without doubt the most important discovery made by prehistoric man; it is probable that his rise from the bestial stage began with it.

Buckle believed history to be the most popular branch of knowledge and the one upon which most had been written. If his opinion is correct it is due to the circumstance that it is hardly possible to deal with any subject without viewing it to some extent historically. But he also considered the most celebrated historians inferior to the most successful cultivators of physical science. The comparison is unfair because the subject matter is widely disparate. The cultivator of a physical science works with his materials directly; the historian indirectly. The former is a good deal in the position of the magistrate who, when trying a case, has his witnesses before him. He can examine and cross-examine until he has ascertained the truth as nearly as possible. The latter is like the same official who has to rely upon affidavits. He can not go behind the returns, or if he does, he has to depend upon surmises and prob-

abilities. Although Buckle wrote a history of civilization and frequently uses the term, as also science and history, I do not find that he defines any of them. He undertook to write a history of human progress that should be as trustworthy as a work on natural or physical science, because he thought it possible to discover and to formulate its laws as clearly as those of the material universe. Neither does M. Guizot define civilization, although he devotes many pages of his work to explaining what he means by the term. M. Rambauld in his recent history of French civilization admits that, notwithstanding the vast amount of work that has been done in the collection of materials, there are still many points to be cleared up. After telling his readers what sort of a history he proposes to write, he sums up by saying: "In a word, how our ancestors lived and by what labors they prepared the better life that we now enjoy." This sort of history approaches most nearly to a physical science because it deals with such general facts that they can be confirmed by a great deal of testimony. We can usually tell how a people who come within the historic period lived, what were their customs and their religion, what was their social and political organization, even when we are constrained to accept with much reservation the reputed deeds of individuals.

The term "science" has of late fallen into almost as great disrepute as the other much-abused word "professor." Both have shared the fate of the man who once upon a time went down to Jericho. We hear of a science of carpentry, a science of journalism, a science of athletics, a science of horse-shoeing, and the like almost without end, every one of which is presided over by its appropriate professor, or by several of them. If we could have a science of humbug, a science of dulness, a science of false pretense, each properly manned or womaned, our gullible public would probably ere long be wiser than it is now. When the English language contained only forty or fifty thousand words, every one had a fairly definite meaning which all intelligent persons understood. Now when it is reputed to include about ten times as many, each one is given the significance that the ignorance or the heedlessness of the user chooses to assign to it. For as Mephistopheles said to the student:

> And just where fails the comprehension,
> A word steps promptly in as deputy.

What doth it profit a man to enter upon the laborious and endless task of seeking for facts when words will serve many more purposes and can be picked up anywhere and everywhere?

History being the written record of events arranged with reference to their relation to each other as cause and effect in the nature of the case is preceded by chronicles. The peoples who inhabited all that part of the world known as the "Ancient East" hardly got beyond this stage. We have characteristic specimens in the Old Testament. In many,

perhaps in all, of the Greek cities, chroniclers were also at work. Wherever language has been reduced to writing men have appeared who kept records. Sometimes they were public officials, sometimes private persons who wrote for reasons which they could probably not themselves have explained. It is known that Herodotus used materials collected by municipal chroniclers when compiling his historical work. He tells the reader that he published his researches in the hope of preserving from decay "the remembrance of what men have done and of preventing the great and wonderful actions of the Greeks and Barbarians from losing their due meed of glory." When he adds that he wants "to put on record what were the grounds of their feud," he enters upon the field of philosophical if not of scientific history.

Except in the quantity of materials collected the modern "local paper" may be regarded as the successor of the old-time chronicles. Its object is to record events from day to day, without taking into account their connection with each other, even when there is such connection. All local newspapers are unreliable except in so far as they publish proceedings of municipal councils, of courts and of other public bodies. None of them print anything that would put a "leading citizen" in a bad light. We may be sure that most of the records of the olden time, except in rare cases, partook of this character. It is evident that any person endowed with ordinary common sense who has a fair education can write a history. All he needs is materials upon which to base his conclusions. But a history written with no other object in view than to set forth facts nobody would read except from a sense of duty or as an act of penance. The work of the historian worthy of the name requires not only judgment in the scrutinizing of evidence, but likewise in the sifting and arrangement of materials and the final form that is given to the narrative. It is probable that in the matter of artistic form the models set up by the Greeks and Romans will never be surpassed. But the range of their discussion is either very narrow, or their statements full of errors. They are chiefly concerned with wars or with those things that pertain to war; they fail to tell us much that we should like to know, and of which they could give us trustworthy information because it came under their immediate observation. They omitted what they considered of no importance; they lacked the point of view of the scientist, to whom nothing that exists is unimportant. It is probable that Professor Freeman formulated his definition of history as "past politics" from a study of the works of the ancients. This definition is now regarded as grossly inadequate because the reading public has come to realize more and more fully that in states which claim to be civilized only a small part of the people are directly engaged in war or politics. Except in rare instances the proportion has never been much larger. Nor does any man now agree with Xenophon that the only

occupations worthy of a gentleman are war and politics. But even Voltaire believed that a state of war was more conformable to the nature of man than one of peace.

The belief that a history should appeal more to the feelings of the reader than to his judgment is now held by few persons. As the drama is the most moving of literary compositions history should be dramatic, that is, it should be a work of art, not a collection of documents. Voltaire maintained that a history like a tragedy should have an exposition, a development of the action, and a catastrophe. He maintained that the historian should not only have an extensive acquaintance with the affairs of the world, but should also be endowed with the capacity for dramatic representation. He calls the citation of documents foolishness, and appeals to the example of the ancients as proof of his contention. Documents he considered nothing more than the scaffolding which is taken away when a structure is completed. Frederic Schiller, who was a skilful dramatist and a writer of the first rank, composed histories without knowing much history. Moreover, he did not pretend to know much. He once wrote to a friend that history was a sort of storehouse for his imagination, the contents of which had to submit to whatever use he wished to make of them, and that he would always be a poor authority for any future writer who should be so unfortunate as to turn to him. The belief that the value of a history depends more upon the style in which it is written than upon the matter which it contains prevailed almost universally until comparatively recent times. Oliver Goldsmith wrote a "History of the Earth and Animated Nature," the title of which he probably borrowed along with a great deal of the matter from Buffon's "Histoire Naturelle." Albeit, more than one of his readers has ventured to doubt whether he could have told a duck from a goose. Yet he produced an interesting work, as I can testify from the impression it made upon me when I first (and last) read it many years ago. Both the Irishman and the Frenchman looked at the world through the medium of their imagination, and consequently saw many things that had no objective existence. In 1877 Professor Du Bois-Reymond delivered an address in Cologne in which he endeavored to prove that the history of mankind is virtually the history of the natural sciences. Although he defended his position with much skill and eloquence, he probably carried conviction to the minds of but few of his hearers and readers. Others have maintained that history is embodied in the efforts of men to invent better tools. It is not easy to see how, viewed from either of these positions, there could be any history for more than a thousand years beginning with the Christian era. There is a great deal of movement and at times a great deal of intellectual activity, but the result was fruitless. In the penal system of former days the treadmill was a common mode of punishment. The exercise

doubtless strengthened the arms and legs of the criminal, but it was without profit to anybody. After the writings of Aristotle became known in western Europe they were accepted as the final word upon every subject on which the Stagirite had expressed himself. Yet he would have been the first man to protest against such a misuse of his books. Far more intellectual ingenuity was expended in trying to prove that they were true than in investigating to what extent they were true. If there is a subject that intimately concerns every man, woman and child, it is the healing art. And it has always been the same. Yet so thoroughly convinced were the minds of the medical fraternity that Galen had spoken the last word upon their profession, that until the beginning of the modern era he had the whole field to himself. When John Locke was in Montpellier he attended the ceremony of conferring the degree of doctor of medicine upon a candidate. Part of it consisted in an address by the head of the faculty which in this case was almost wholly taken up with a diatribe against Harvey's theory of the circulation of the blood.

The history of medicine illustrates in a striking way the tendency of the human mind to stagnate and dogmatize, and demonstrates how an art eventually becomes impregnated with the scientific spirit. The infancy of medical science falls in the middle of the seventeenth century; it is therefore not three hundred years old. In the Iliad physicians are held in great esteem by the Greeks. Herodotus tells us that the medical art was highly specialized in ancient Egypt and that there were physicians for almost every part of the body. Embalmers were also classed among physicians, for we are told in Genesis that Joseph commanded the physicians to embalm the body of his father. That there were practising physicians in Palestine at an early period is evident from a few passages in the Old Testament. When we reflect that the ancient Greeks were almost continually at war either with barbarians or among themselves, it seems incredible that their books tell us almost nothing about the care of the sick and wounded in their armies. Xenophon relates that once during the retreat of the Ten Thousand, after a particularly severe conflict with the enemy, the officers found it necessary to appoint eight physicians because there were many wounded. If he had said "additional" we should suppose that the number of those whose duty it was to attend to the disabled was insufficient. The passage clearly conveys the meaning that there had been no previous provision for an organization corresponding to the modern ambulance corps. It is doubtful if the ancient Greek language contains a word corresponding to our "hospital." Hippocrates did not dogmatize, for the reason that he was one of the world's really great men. But some of his pupils founded the Dogmatic school; and while they made a few discoveries, their system was vitiated by philosophical theorems and

subtleties. For nearly two centuries they had the field to themselves, when the inevitable reaction came and the Empirical school arose. This was in some measure a return to first principles. Some centuries later appeared Themison of Laodicea, who was the most conspicuous person among the disciples of the Methodical school. He endeavored to trace all diseases to a few types and to find a cure for each type. Here was evidently something more than a mere glimpse of the real state of the case. His contemporary, Athenæus of Cilicia, founded the Pneumatists, whose adherents assumed the existence of an air-like substance in the human body, to which its condition both in health and disease was due. Agatinus of Sparta, the father of the Eclectic school, came a little later. The circle of medical theory was now complete. Galen, at a subsequent period, compiled a sort of medical encyclopedia, and although he was both a careful observer and a profound thinker he could not free himself entirely from the prejudices of his age. About a thousand years later several physicians of note appeared among the Saracens and the Jews; but their skill was due rather to sanity of judgment than to knowledge of the healing art. All the sciences and most of the arts have every now and then found themselves in a blind-alley where no further progress was possible until some hitherto unknown way out had been discovered. Medical knowledge and skill had probably exploited their opportunities to the utmost seventeen or eighteen centuries ago. There was no advance possible until the microscope had reached a high degree of excellence. The progress of chemistry had also an important bearing on the healing art. An air-ship sufficiently powerful to carry a man has been desiderated ever since Dædalus made his famous flight from Crete to Italy. Albeit, there seemed to be no possibility of repeating the performance until either the original secret had been rediscovered or some fuel lighter than any known a generation ago. Michael Faraday declared that "there is not a law under which any part of the universe is governed that does not come into play in the phenomena of the chemical history of a candle."

The history of human thought as distinguished from the history of human acts is at bottom a quest for the fundamental principles by which the cosmos is governed. "Philosophy," says Schwegler, "deals with the *totality* of experience under the form of an *organic system* in harmony with the laws of thought." But as the totality of experience is not the same to-day that it was yesterday, nor will it be the same to-morrow that it is to-day, we are always getting a little nearer to a goal which can never be reached. The history of philosophy is for the most part the history of efforts to systematize knowledge from the observation of a comparatively small number of facts. The mistakes into which such a method leads is now so fully recognized by historians of human actions that they refuse to formulate a philosophy of history. They assure us

that it is as unscientific, and therefore as illusory, to seek a plan in the course of events as it would be to seek a plan in the constitution of the cosmos. Some of their maxims are:

> Tell us nothing except what the evidence before you warrants and tell us everything for which you find evidence, so far as the space at your command will permit. No man has a right to ask for himself or for his friends immunity at the bar of history. The historian is a judge, not an advocate.

There can be no doubt that the gradual change that has come over the attitude of the more intelligent public opinion toward the past is due to the progress of physical science. The man who is in advance of his age usually has to pay the penalty for his rashness. How many men beginning with Anaxagoras have suffered banishment, imprisonment and torture for daring to know more than those who had his fate in their hands. It is a melancholy tale that has been repeated over and over again. Albeit, in the conflict between conservatism and radicalism the latter has always won in the end. To it has come the reward that always comes to the undismayed searcher for truth.

The fundamental principle of art is deception. A work of art is either an illusion or a delusion. It is never an exact reproduction of nature, of facts. A portrait which accurately represents an original is not artistic. A painting, a photograph, an engraving is such a disposition of white upon black or of colors as to produce the illusion of relief. An accurate drawing can not be made of a work of art. Neither can work on chemistry, or on physics or on biology or on mathematics be made artistic. The same is true, in a large measure, of historical writings. A faithful chronicle is not a history even when the connection between cause and effect is clearly set forth. It comes too near the truth, it approaches too close to science to be interesting to the great majority of readers. Hence the more artistically a history is constructed, the more popular it is likely to become, and likewise the more unreliable. The purpose of the artist is to produce pleasure by deceiving the spectator or the reader. Every historian endeavors to make his work interesting, readable. No scientist feels such a prompting. The distinction that is now usually made between the terms science, knowledge and learning is not of long standing. Bacon's "Advancement of Learning" is merely a translation of "De Augmentis Scientiarum." Science, as now generally interpreted, means the accumulation of facts relating to man and the universe that have been discovered because they were sought. *Learning* is used to designate data that have been stored up in the memory without examination of their accordance with facts. A man may be very learned, yet be in possession of a very small quantity of real information. *Knowledge* is used to designate those facts that men have come into possession of by experience and observation. Rome grew great and eventually made itself master of the known world with-

out having produced a single scientist. Pliny is the only Roman who has the slightest claim to this designation. Yet his "Natural History" is such a vast collection of absurdities that one wonders how an avowed atheist could think it worth while to record them. He cites nearly five hundred writers as his authorities, and it is known that he was an indefatigable reader. But he had time neither to think nor to observe. He was conscientious in the performance of every duty incumbent upon him, and thought he was doing posterity a great service in the compilation of his work. He was skeptical in everything that came under his own observation, and credulous of the testimony of others. He was a predecessor of Faust who at one period of his career congratulated himself that he knew more than everybody else, was haunted by neither doubts nor scruples, feared neither hell nor the devil, hence had given himself over to magic. It is unscientific to call anything that happens or is, "strange"; yet one is often tempted to apply the epithet to that characteristic of man that makes him averse to the truth when it is disagreeable or conflicts with preconceived opinions. Opinions and beliefs can not change the most insignificant fact. It is only the truth whether in science or history that abides.

THE ANTECEDENTS OF THE STUDY OF CHARACTER AND TEMPERAMENT

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THE strong practical interest in the sources and varieties of human powers and their proper direction and training, may be utilized in behalf of the retrospective aspects of the subject. The antecedents of "character and temperament" concern in the main the story of false and ambitious leads and venturesome solutions of the sources of human nature. However completely discredited, they belong to the irrevocable stages of our intellectual heritage, and show how uncertain has been the occupation of the psychological realm. The historical connection between the antecedents and present-day views is irregular; the succession of opinion is largely by replacement and outgrowth. None the less the points of connection are frequent with the body of knowledge which we draw upon so readily for the satisfaction of our systematized and rationalized inquiries.

The popular interest in human nature is itself an expression thereof. Actions are largely regulated as well as interpreted by psychological considerations; and these turn attention to the nature of the mind. The feeling of strong impulse, the sense of conflict between emotions as also between desire and sanctioned conduct, the search for motives, as well as the shrewdness of the battle of wits, and the reading of another's intentions shape psychological insight. "Know thyself" is an ancient precept—at once a moral injunction and an invitation to psychological study. The early contributions to the field to be surveyed came from the learning aptly called "the humanities," and reflected the insight of experience, directed by an unschooled but worldly-wise analytical temper. Quite as science is glorified common sense, so is literature elevated common sentiment; either may fail to rise above a suggestive type of opinion or pleasing conjecture. The delineation of character springs from the impressionistic attitude towards the products of nature and the vicissitudes of fortune. It is animated by a fundamental interest in one's kind. It trains men to be practitioners, empirics in large measure, in the arts of human intercourse, and tends to establish man as the proper study of mankind.

The distinctive service of Greek thought was to launch the permanently engaging intellectual problems; to this rule the problem of character is no exception. It presents the two tendencies—the impressionistic and the analytic—in characteristic form. Theophrastus (370–288 B.C.) is the prototype of the impressionistic delineators, yet is not

without an analytic strain. He sets forth his intentions thus: That although all Greece is of one

> clime and temperature of air, and Grecians in general bred and trained up after one fashion, should notwithstanding, in manners and behavior be so different and unlike. I therefore, O Polycles, having a long time observed the divers dispositions of men, having now lived ninety-nine(?) years, having conversed with all sorts of natures good and bad, and comparing them together: I took it my part to set down in this discourse their several fashions and manners of life. For I am of the opinion, my Polycles, that our children will prove the honester and better citizens, if we shall leave them good precedents of imitation: that of good children they may prove better men.

The "Characters" of Theophrastus form a group of sketches of human foibles, holding the mirror up to nature, comprising the dissembler, the flatterer, the gossip, the toady, the fop, the miser, the superstitious, the mistrusting, the querulous, the bully, the coward, the stubborn, the pompous, the boor and the bore, the malaprop of either sex, the well-intentioned fool and the public-disregarding autocrat. This gallery of mental and moral shortcomings served as a model for distant ages. A group of delineations of character appeared in England in the seventeenth century; and the model was still suggestive when George Eliot chose the title for her "Impressions of Theophrastus Such." The modern delineations emphasize circumstance, the vocations and social stations, reflect a more varied, a more specialized, and a more complicated world. The "idle gallant," the "meer dull physician," the "upstart country knight," the "pot-poet," the "plodding student," the "down-right scholar," as well as the "self-conceited man," the "vulgar-spirited man," the "too idly reserved man," and men of other dispositions are subjected to keen strictures in the "Microcosmography, or a Piece of the World Discovered in Essays and Characters" by John Earle (1628). Such portraitures of human peculiarities, gauged by their moral or social desirability as examples to be followed or avoided, form an attractive compendium for the interpretation of men and their ways. Their consideration, ranging from gossip to philosophy, supplies the common touch of nature that makes the world of every time and clime akin, and presents graphically for our psychological contemplation the outward issues of disposition as shaped by opportunity and circumstance.

This vein of character-mining failed to yield the native ore of disposition. The more fundamental problem was early recognized in the venerable doctrine of the temperaments as the alleged determinants of the original yet distinctive natures of men, and in the general notion that outward uncontrollable forces, such as climate, and directive ones, such as breeding and training, were responsible for the types of individuals and races—as duly indicated by Theophrastus. The doctrines of the school of Hippocrates (fifth century B.C.) formulated the Greek point of view. Its philosophical procedure followed that of Em-

pedocles in the search for elements and in the explanation of manifold appearance as their variable combination. The elements of creation were regarded as fourfold: Air, fire, earth and water. These are distinctive by virtue of elemental qualities: namely, dry and moist, hot and cold, heavy and light, which by combination yield the qualities of the elements: fire as hot, dry and light; water as cold, moist and heavy, and so on. The fourfold elements of the body are the *humors* or fluids: the blood, the (yellow) bile, the phlegm, and the black bile. (3) Subjected to the play of analogy and correspondence in the speculative manner then employed, *blood* becomes related to *air,* has the quality of being *warm* and *moist;* the season which it typifies is *Spring,* and its temperament is the *sanguine.* Its direct opposite is *earth,* which is *cold* and *dry,* finds its bodily correspondent in the *black bile* and its season in the *Fall* of the year; its temperament is the *melancholic.* Fire as *warm* and *dry* has special relations to *Summer,* is represented in the body by the *yellow bile,* and produces the fiery or *choleric* temperament; while water as *cold* and *moist* is allied to the *phlegm,* to the sluggish season of *Winter,* and to the languid temperament which we still, in deference to Hippocrates, call *phlegmatic.*

These views were held as much more than speculative possibilities; they were practically applied. Diseases were regarded as defects in the composition of the humors, to be counteracted by appropriate applications of heat and cold, or of dry and moist, to restore a favorable equilibrium. Winter was held to be the dangerous season for a temperament lacking in fire; the body must not be too full of humors nor yet be too dry and sapless. The several ages of man, from childhood to senility, reflected the natural sequence of dominance of the several humors.

The doctrine of temperaments is historically important quite beyond any illumination which it affords. It is obvious that the philosophers of the school of Hippocrates had no means of ascertaining that cheerfulness was resident in the blood, laziness in the phlegm, testiness in the yellow bile, and low-spiritedness in the black bile; nor that any such fundamental vital basis was afforded by the "humors" thus distinguished. Their habits of mind inclined them to such an opinion; and their sense of plausibility was gratified (where we see only far-fetched and irrelevant analogy) by observing the hot moist fluidity of blood and the damp cold sluggishness of phlegm. The originators of the doctrine of temperaments were empirical psychologists, who observed that differences of mental disposition, like cheerfulness and testiness, were common and conspicuous traits of men. They were also medical practitioners with a fair knowledge of the body and its ills, and recognized that mental dispositions were intimately related to bodily condition. Their philosophical temper found satisfaction in connecting these two varieties of information through the doctrine of the temperaments.

This doctrine does not stand alone as such an attempt. The "spirit" theory of disease has a like basis and purpose; it reaches from primitive medicine to Christian exorcism and beyond. The reference of epilepsy or other mental invasion to a foreign and malignant spirit is not unrelated to the notion of animal spirits coursing through the body and finding a local habitation in the ventricles—literally, breathing-spaces—of the brain. Again, the doctrine of signatures, in accordance with which red flowers were considered efficacious in the treatment of blood diseases and yellow ones in the treatment of jaundice, or "heart's-ease" was prescribed for heart trouble, and walnuts for mental disorders (by virtue of the resemblance of their outer shell to the skull and of their convoluted kernels to the brain) illustrate the force of native analogy in cruder practises.

When notions of this order, instead of being carried along as the folk-lore products of primitive thought, assume a systematic form, they become more fantastic in the analogies employed as well as more remote from a corrective common sense. Astrology is the most ambitious of such efforts in both design and scope of application. The three persistent motives in this world-wide and world-old expression—a composite of primitive culture, superstitious survivals, and pseudo-scientific elaboration—seem to be the cure of disease, the reading of character, the fore-knowledge of the future and in all, the control of fate. The motives combine. Astrology aims to determine the character as well as the careers of men, to predict their liability to disease and its issues, and to prescribe the set of disposition—making one of jovial temperament if the hour of birth showed favorable relations to Jupiter, or gloomy (saturnine) if Saturn ruled the critical moment. These and related notions and systems form a vast background of belief, continuously influencing the views of character and its sources. Whether the causes or the signs of dispositions were regarded as resident in the fluids of the body, or in the stars and planets, or in the detailed contours of the features of the face and head—as in the later physiognomy, itself a revival of classic and popular lore—or with more modern but no less fanciful elaboration, in the "bumps" of phrenology, or again in the creases of the hand upon which palmistry specializes, there appears in all a common practical motive in the control of fate through insight or revelation, and a common quasi-logical attempt to establish its basis by reading the secret of its conditioning—the insignia of its dominion. The logic of the procedure, as judged by our standards, is of the feeblest, but these standards are the issue of many generations of experience, each critically testing the conclusions, revising and enlarging the data, of its predecessors. The stress of practise, we must bear in mind, is insistent. Men will apply what knowledge they have; they can not await its perfection. Ideals and systems support the intercourse with reality, but they also express the

progress attained in reading its meaning; the ideal "has always to grow in the real, and often to seek out its bed and board there in a very sorry way" (Carlyle).

The ancient and honorable place of the doctrine of the temperaments in the evolution of psychological knowledge warrants its further consideration. Most influential were the contributions of Galen (A.D. 130–200), who developed the views of Hippocrates and whose authority dominated the medical world for centuries. The doctrine became a classical heritage through its incorporation in the Galenic system of medicine. Its survival in the transfer of Greco-Roman science and tradition across the desert of unprogressive ages, with their uncertain and irregular caravans of learning, was due largely to its association with the "humoral" theory of disease. This remained a central as well as a controversial issue in medieval and renaissance medicine, and was effectively retired only by the complete transformation of physiological conceptions inaugurated by Harvey's discovery of the circulation of the blood (1628). Along with this decisive reform in knowledge and method there was established the clinical temper of the practise of medicine, which was as largely set by Sydenham (1624–1689), as were the experimental standards by Harvey, as similarly the anatomical prerequisite had been supplied by Vesalius (1514–1564). Cumulatively these advances served to cast off the spell of Galen and to install verification and observation in place of authority. As a herald of the new learning, the philosopher John Locke, a friend of Sydenham's, wrote:

> You can not imagine how a little observation, carefully made by a man not tied up to the four humors (Galen) or salt, sulphur, and mercury (Paracelsus), or to acid and alkali (Sylvius and Willis) which has of late prevailed, will carry a man in the curing of diseases, though very stubborn and dangerous; and that with very little and common things, and almost no medicine at all.

These considerations show to what extent practises kept alive systems precariously supported by principles. Symptoms such as fevers and chills, parching and perspiration, substantiated the hot and cold, the dry and moist as clinical realities. Remedies were prescribed to counteract them, diets were arranged according to degree of dryness and moisture. Even when the classic doctrines were discarded, they were replaced by others developed in like manner.[1]

[1] Medical theories and practise were reflected in popular lore. To recall the spirit of the ministrations it is sufficient to cite the venerable Chaucerian diagnosis made by Pertelote of Chanticlere's affrighting dream. This was ascribed to "the grete superfluitie Of your reede colera, parde, Which causeth folk to dremen in her dremes Of arwes, and of fyre with reede leemes, Right as the humour of malencolie Causeth ful many a man, in sleep, to crye, For fere of beres, or of boles blake, Or elles blake develes woln him take. Of othere humours couthe I telle also, That wirken many a man in slep ful woo; But I wxol passe as lightly as I can. . . ." She then advises digestives and laxatives to purge him of "choler" and of "melancolie," though she bids him remember

It is fortunate that the older currents of thought, medical and otherwise, were summarized at the very period at which they were destined to retirement by Harvey's fundamental discovery. Burton's "Anatomy of Melancholy" is a collection of all the mystic, fantastic, engaging and (to our minds) incredible procedures of an ambitious science, suggestive of the waste-products of the mind. Burton anatomizes the humors, recognizing the four primary juices

without which no living creature can be sustained; which four, though they be comprehended in the mass of the blood, yet have their several affections. . . . Blood is a hot, sweet, temperate, red humour, prepared in the meseraic veins, and made of the most temperate, parts of the chylus in the liver whose office is to nourish the whole body, to give it strength and colour, being dispersed by the veins through every part of it. And from it spirits are first begotten in the heart, which afterwards by the arteries are communicated to the other parts

and so on, with a like conjectural anatomy and acrobatic physiology for the other humors. Burton's appetite for the occult inevitably made him a believer in astrology. It is a fact that his horoscope is pictured on his tombstone, but it is presumably but a rumor that he assisted the fulfillment of the prediction of the time of his death by hanging himself. Burton's work is suggestive in view of the career of the doctrines which superceded the "temperaments" as practical exponents of character. It indicates the ready temptation for views of this nature to degenerate into vain pseudo-science, and under a common enthusiasm and prepossession to bring together in mutual tolerance diverse

that he is "full colerick of complecioun" and should beware of the "sonne in his ascensioun." Among the artists, Albrecht Dürer reflected the current belief that temperament was responsible for the differences of men. He urged that artists should present the features and proportions suitable to the characters of their subjects. One of his ripest productions, commonly known as "The Four Apostles," also bore the title of "The Four Temperaments."—St. John representing the melancholic, St. Peter the phlegmatic, St. Paul the choleric, and St. Mark the sanguine.

The affiliation of "humors" and temperaments appears in the transferred use of the former term. The dramatic material of the age of Elizabeth with its free emphasis of personality, was typically staged in Ben Johnson's (1574–1637) "Every Man in His Humour" and "Every Man Out of His Humor." The following is from the induction to the latter.

"To give these ignorant well-spoken days some taste of their abuse of this word humour," the argument proceeds: "Why, *humour* as 'tis *ens*, we thus define it. To be a quality of air, or water, And in itself holds these two properties, Moisture, and fluxure: as, for demonstration, Pour water on this floor, 'twill wet and run: Likewise the air, forced through a horn, or trumpet, Flows instantly away, and leaves behind A kind of dew; and hence, we do conclude, That whatsoe'er hath fluxure, and humidity, As wanting power to contain itself, Is humour. So in every human body, the choler, melancholy, phlegm, and blood, By reason that they flow continually In some one part, and are not continent, Receive the name of Humours. Now thus far It may, by metaphor, apply itself Unto the general disposition: As when some one peculiar quality Doth so possess a man, that it doth draw All his affects, his spirits and his powers, In their confluctions, all to run one way, This may be truly said to be a humour."

notions of like conjectural basis. Their common motive is a strong leaning towards the occult.

The parent view that mental traits are conditioned by bodily composition affiliated with views of similar ancestry holding that the traits were revealed in bodily signs. Such is the principle of physiognomy,—a doctrine as old as Aristotle, and older. There is the traditional story that the physiognomist Zopyrus, in reading the character of Socrates, pronounced him full of passionate tendencies, thus showing in the opinion of the disciples of Socrates, the vanity of his art. But Socrates came to his defence and confessed the reality of the impulses, which, however, he was able to resist. Aristotle's advocacy of physiognomy was not very pronounced; it may have been little more than an inclination to recognize the reflection of emotion in feature, or the coordinate growth of body and mind. But the tractate on "Physiognomy" ascribed to him served as the text to the renaissance adepts in occult lore. Thus restated, even more than in its original setting, it presents the characteristic dependence upon weak analogy in connecting specific bodily features with specific mental traits. Coarse hair, an erect body, a strong sturdy frame, broad shoulders, a robust neck, blue eyes and dark complexion, a sharp but not large brow, were together regarded as marks of the *courageous* man, while the *timid* man showed opposite characteristics. The doctrine was reenforced by such analogies as that timid animals, like the rabbit and the deer, had soft fine hair; while the courageous ones, like the lion and the wild boar, were coarse-haired.

A mental trait may have at once a natural bodily cause and a manifest or covert sign. The "humorist" may also be a physiognomist, may both account for and read human character, may prescribe for its ailments according to the one set of influences, and advise as to course and career according to the other.

There is no more instructive instance to illustrate how the old learning was reinstated with slight alteration in precept and practise than the career of Jerome Cardan (1501–1576). Esteemed by his contemporaries, shrewd and able, he was urged in one direction by his taste for science and in another by his credulity. His autobiography reveals his analytic bent as well as his strong personality. It has been said of him that for all for which his contemporaries thought him wise, we should think him mad; and for what we think him wise, they would have thought him mad. So great was his reputation that he was invited and then inveigled to travel from Naples to Scotland to treat the bishop of St. Andrews. The prelate's ailment had been described as a periodic asthma due to a distillation of the brain into the lungs, which left a "temperature and a condition too moist and too cold, and the flow of the humors coinciding with the conjunctions and oppositions of the moon." With the characteristic prestige that re-

sults from finding others in the wrong, Cardan promptly found that the Archbishop's brain was too hot and too dry. He put his distinguished patient on a cold and humid diet to resist the attraction of the brain, yet had him sleep on a pillow of dry straw or sea-weed, and had water dropped upon his shaven crown; in addition, however, he prescribed a regimen of simple food, much sleep and cold showers. The improvement that resulted—naturally ascribed to the "humoral" procedures,—added much to the glory of Cardan's reputation and the profit of his purse. This physician, learned and wise for his day, was yet the very embodiment of all things superstitious. Every trivial occurrence was an omen or potent. He cast horoscopes, wrote on all manners of cosmic influences, and espoused the rôle of a physiognomist. His distinctive contribution was an astrological physiognomy, based upon the underlying notion that the furrows or lines of the forehead *correspond* to the seven dominant celestial bodies; and that the qualities which they denoted were those connected with the powers and virtues conferred by Venus, or Jupiter, or Saturn, or Mercury, etc., in the current astrological system. Across the forehead he drew seven parallel lines, the spaces in succession dedicated to the moon and the six planets, and by the proportions and prominences of these lines he read the fortune of the subject, not hesitating in one case to predict from the grouping of these wrinkles that the owner thereof was doomed to die by hanging or drowning.

In such manner the humoral doctrine served to determine the diagnosis of disposition and ailment, while from astrology and physiognomy were drawn further indications of personal character and probable fortune. Hardly less significant for the logical temper of these pre-Harveian days were the contributions of Giovanni Baptista della Porta (1538–1615). He was impressed by the comparative physiognomy sketched in the Aristotelian writings—a field in turn indicating the strong impression that the traits of animals make upon the thought-habits of primitive people; it appears in totemic practises, as well as in animal fables from Æsop to Br'er Rabbit. The notion that stubborn persons will carry the outward sign of their obstinacy by having features in common with the face of a mule, or that foolish ones will show a like resemblance to a sheep, impresses the modern reader as a strange joke. The analogy will barely support a pleasantry or a metaphor. We are fully conscious of the metaphor of our epithets, when we call an obstinate person mulish, or a shy one sheepish, or a man of sly ways an old fox, or speak of a social lion or a wise owl or a gay butterfly; it is significant that what was once serious logic is now playful figure of speech. It is also in accord with the principle of survivals in culture that the notions made current by generations of credulous "physiognomists" continue to be circulated in the popular

manuals sold to simple folk to teach them the art of reading faces and futures.[2]

All this would be as irrelevant retrospectively as it is to our central purpose, were it not that it indicates the presence throughout the ages of a considerable body of popular lore and systematized doctrine—both saturated with flimsy analogy and engaging prepossessions—which was available for the ambitious renaissance of the interest in character and its signs in the face, through its best known apostle, Johann Caspar Lavater (1741–1801). The contrast between Lavater and such men as Cardan and Porta is as marked as that of the spirit and scope of the scientific study of their respective times. The vagaries of the sixteenth century may have stood measurably aloof from the real, if slow and uncertain, advances in the knowledge of mind and nature then maturing; but they were not wholly remote, not wholly tangential to its orbit. This was no longer true of the eighteenth century. Lavater, despite his reputation and associations and the imposing effect of his ambitious publications, failed to affect seriously or to divert the increasing stream of scientific discovery to which the early eighteenth century gave momentum. The scientific contemporaries of Lavater judged his views as critically, appreciated their wholly subjective basis in a personal predilection and their lack of objective warrant quite as justly as we of today. The contrast of attitude appears equally in the all but complete desuetude of the old persistent pseudo-sciences, astrological and others.

Lavater had nothing new to offer in principle or data or method. He was an impressionistic enthusiast setting forth conclusions with a minimum of argument, and convictions with a minimum of proof. His system was based upon subjective interpretation. His delineation of character has a direct reading of detailed mental traits by an interpretation of their equivalents or representatives in features and expression. Lavater's activities were manifold. Preacher, orator, philanthropist, political reformer, dramatist, writer of ballads, he was a conspicuous man of his times, highly regarded by his eminent contemporaries—among them Goethe, whose contribution to the *Fragments of Physiognomy* have been identified. He was quite without scientific

[2] Nothing less than a glance at the illustrations which the earlier physiognomists employed will convey an adequate impression of the vagaries of Porta and his kind. They show that what was once pictorial proof has become the artist's pastime. The material presented for amusement in Lear's "Nonsense Botany" or Wood's "Animal Analogues" is hardly more remote than that which served Porta as a serious instrument of research. Thus a portrait of Plato is printed side by side with that of a dog, and one of Vitellus Caesar is paralleled by that of a stag; and in each case some of the most deserving qualities of the animal are regarded as typical of the human embodiment. Similarly distorted illustrations show human resemblances to a lion, or a bull, or a donkey, or a deer; while the picture of a girl is ungallantly made to approach the features of a pig. These and yet more capricious ventures in animal physiognomy were incorporated into later systems, often in complete ignorance of their source.

bent or training. Yet his name was so commanding in the annals of physiognomy as to distract attention from the slightness of the foundations upon which his elaborate superstructure was raised. Indeed, the impressiveness of elaborate plates and luxurious editions, and the support of distinguished but uncritical patrons, were responsible for much of his fame. The reader who desires first-hand acquaintance with Lavater must be prepared for tedious assertion, for generalities that do not even glitter, for persistent avoidance of real issues, for the futile contention and misunderstanding of a propagandist. Of method he had little, and for the most part translated directly and by use of a dictionary of fanciful etymologies, from the language of a superficial anatomy into that of a wholly arbitrary psychology. He presented a popular, empirical grouping of feature-interpretation by virtue of a certain common-sense shrewdness, which he elevated to the dignity of a universal physiognomical sense—"those feelings which are produced at beholding certain countenances, and the conjectures concerning the qualities of the mind," which the features suggest. The extensive collection of portraits alone offset the tedium of the text. Lavater was an expert draftsman, and a diligent collector of engravings, outline drawings, and the silhouettes then in vogue. To each picture he attached a character-reading, which reflected little more than his personal impression or knowledge of the subject, to which occasionally were added special correlations of such traits as prudence, cunning, industry, caution, determination or what not, with the forehead, the eye, the nose, the mouth, the chin.

It was inevitable that the practical interest, lacking the compensations of Lavater's serious purpose, rapidly turned physiognomy into vulgar quackery. The followers of Lavater developed a craving for handy recipes by which to interpret the meaning in terms of character, of chin, forehead, eyebrows, and of the several distinctive combinations of feature, by an arbitrary or plausible system of signs. Physiognomy degenerated into a baseless and senseless empiricism. Oblique wrinkles in the forehead were held to indicate an oblique or suspicious mind; small eyebrows with long concave eyelashes were made the sign of phlegmatic melancholia; long high foreheads were advised not to contract friendships or marriages with spherical heads; such was the detailed but arbitrary correlation oracularly set forth with no more analysis or understanding of facial traits than of mental ones.

Lavater's work supplies a convincing and not too ancient example, if such be needed, of the limitations of impressionism as a basis for the study of character and of its utter futility for the purposes of a sound psychology; and that apart from the like disqualifications resulting from an ignorance of the significance of such somatic features as those which formed the basis of the system. It shows how readily an en-

thusiastic but unintelligent industry may build a monumental construction upon a hollow foundation. It illustrates as well a specific psychological fallacy: that of exaggerating the significance of traits in which we have an interest. It is the general human appeal of the face and its expression and its place in human intercourse that supplies the interest so readily abused by popular writers or commercial charlatans. It is just this realm of loose analogy and unchecked ambitious conclusions that attracts feeble minds with a taste for speculation and an inclination for the occult, the bizarre, the esoteric; such a taste, as if to appease a neglected, logical conscience, usually finds refuge in a practical semblance of verification. It is this combination of interests that supports physiognomy or phrenology, palmistry or fortune-telling, and (with an altered complexion) Christian Science or Theosophy,—in which latter examples cures or miracles instead of readings supply the realistic support.[3]

A possible redeeming feature of Lavater's work is his recognition of facial expression as worthy of study; in this he followed the leadership of the artist LeBrun. Expression is much more generic and more readily interpreted than are peculiarities of feature. In such biblical maxims as "though a wicked man constrain his countenance, the wise can distinctly discern his purpose," Lavater found a text for his exposition. Of the true meaning of expression, so far as it was possible before Darwin, he had slight understanding. His physiognomical sense conferred no physiological comprehension. Indeed, so far as he ventured into the biological territory, he reverted to the older notions, and made fish and fowl and even insects reveal their character by their effects upon the human impression. In an engraving of the heads of snakes he pointed out the reprobate qualities distinguishable in their form, the deceit of their colors, and the naturalness with which we shrink from such a countenance. The logic of physiognomy, ancient or modern, learned or ignorant, is of one kinship; it is the family associations that in time and circumstance come to be less and less respectable.

The next and last stage in the antecedents of the study of character presented a new rôle, or, it may be, an old one in a new and distinctive costume. In its practical effect and later career it resembles the system of Lavater, and invited yet greater popular abuse. Its founder was Dr. Franz Joseph Gall (1757–1828); and it achieved popularity under the name of *Phrenology*. While Lavater stood beyond the pale of the scientific activity of his day, Gall was an influential part of it. Gall's scientific service must be acknowledged even if he be held responsible for the extravagances of phrenology. The system was

[3] For the general subject I may refer to my volume: "Fact and Fable in Psychology," 1900.

extended and popularized by Dr. Johann Caspar Spurzheim (1776–1832), Gall's associate, and his successor as leader of the movement.

There are two distinct aspects to the work of Gall and Spurzheim; and it is not easy to understand or to set forth just how the connection stood in the minds of these contributors to the anatomy and physiology of the nervous system, and advocates of the locations of elaborate mental faculties by means of cranial prominences. The two orders of contributions are difficult to reconcile either in spirit or in method. The motive of "character-reading" was operative, though restricted by scientific considerations. It was forcibly made the consummation of a system quite irrelevant to the purpose. In the end, the practical temper prevailed; and phrenology allied with physiognomy, palmistry or other character-reading pretences, degenerated to the woeful state of a *declassè* pseudo-science. Its nearness to the illuminating truth served but to intensify the obscurity of its shadows. The contrast in the two spheres of the career of Gall and Spurzheim serves to explain why, as they travelled about Europe, they were by some called "a pair of vain-glorious mountebanks," and by others placed with Newton and Galileo as illustrious contributors to science. Yet the fact that phrenology called larger attention to the study of character than had any other movement gives it an important place in a retrospective view.

The impressionistic origin of his phrenological interests is thus recounted by Gall. When at school, he was struck by the fact that his schoolmates had facilities independent of instruction; that one was musical, another artistically endowed, and that this innate ability rather than application was most decisive in determining progress. He seems to have been annoyed at being surpassed by schoolmates who had a capacity for memorizing; and in an inauspicious moment he observed that these schoolmates all had prominent eyes. At the university he directed his attention to students with prominent eyes, and persuaded himself that in every case such men had exceptionally good verbal memories; and thus was the fatal correlation made. Not unlike Lavater, he trusted to his "physiognomical sense" to recognize the prominences which were to find a local habitation and a name upon the phrenological chart. At church he observed the most devout of the attendants, detected what portions of the skull were well-developed in them, and discovered the organs of *veneration.* He compared the heads of murderers and found an organ of *murder,* and similarly studied the heads of thieves and located the organ of *theft.* He had organs for the preeminent quality of each of the five senses; an organ of *tune* for the musical, and one of number for the *mathematical.* He thus accumulated a group of some twenty-four organs (which Spurzheim enlarged to thirty-five or more), and in this contribution disclosed with strange unconcern at once his self-deception and the shallowness of his psychological notions.

The common assumptions of physiognomy and phrenology (as we readily detect, though not thus obvious to the minds of their defenders) are these: (1) that there are distinct mental traits, qualities or capacities, which ordinary human intercourse and observation reveal; (2) that these are caused by (or correlated with) prominent developments of parts of the brain; (3) the critical assumption (presumably least explicit of all) that we may accept as established the relation whereby the one, the bodily feature, becomes the index of the other, the mental trait. The assumed principle of relation was plainly empirical, had no warrant in principle. The clue in all such systems was merely a sign or trade-mark displayed, in Lavater's theological view, by a beneficent Providence to indicate the virtues and vices of men. For phrenology the alleged principle was wholly different. It grew out of the subdivision of the functions of the brain. The evidence, it must be admitted, was sought by approved scientific methods. But the stupendous assumption was made that the presumption in favor of the *existence* of such specialized brain-areas included a *knowledge* of their *terms,* and that their nature was indicated by the specific differences in the observed traits of men; further, that such mental traits, giving rise to or conditioned by marked local development of brain-areas, could be detected in the corresponding prominences of the skull. So supremely unwarranted was this cumulative series of assumptions that the scientific knowledge and procedure associated with its alleged establishment failed to confer upon phrenology any more respectable status or accredited position than were accorded to the far more extravagant assumptions of physiognomy. Clearly, if the assumptions of phrenology held—itself an extravagant supposition—the study of character and temperament would be completely shaped by its conclusions. Since they are neither pertinent nor illuminating, physiological and psychological studies still have a message for the student of human nature.

The chief warrant for a further consideration of the position of Gall and Spurzheim is that their views came into direct contact with the advances in the knowledge of the nervous system, which—as will duly appear—became the requisite for true psychological progress. The central question at issue was whether the brain functioned as a whole, or whether distinct functions could be assigned to its several parts. The former position was defended by Flourens (1794–1867), who maintained that the removal of a part of the brain of a pigeon weakened the general intelligence, but that the intact portion still exercised the complete range of brain-functions, though with diminished efficiency. Gall's position required a detailed and specialized division of function. He drew attention to the fact that the mutilated pigeon, while retaining physical sight and hearing, became mentally blind to the meaning of what it was clearly able to see, and mentally deaf to the meaning of sounds; he drew attention to the important evidence sup-

plied by the association of mental symptoms with injury or disease of different portions of the brain, and noted that these were very different according to the region affected. His contentions proved to be correct in fact, in interpretation, and in method. In this controversy Gall argued physiologically, not phrenologically. In another controversy the reverse was the case. Flourens restricted his conclusions of the unity of function to the cerebrum, and confirmed the experiments on pigeons which showed that the cerebellum regulated locomotion. Gall had made the cerebellum the organ of amativeness; if it regulated the love-affairs, it could not regulate the gait. He replied first physiologically, that the experiment was defective, and the motor impairment due to concomitant injury of other parts of the brain; and then phrenologically, that if the cerebellum were the organ of locomotion, it would follow that persons with large cerebellums should be acrobats, and asked whether women (who in Gall's view possessed a small cerebellum) "walked and danced with less regularity, less art, less grace than men." Controversies of this kind were futile in view of the wholly irreconcilable positions of the advocates. In the end the phrenological position became an obsession.

At one other point phrenology came in contact with the advances leading to modern psychology; this is in its alliance with the study of hypnotism in the career of James Braid (1795-1860). The remarkable insight of this investigator enabled him to recognize under disadvantageous conditions the true nature of this mental state as a partial disqualification of the nervous system; but it did not prevent his temporary subjection to the phrenological fallacy. He refuted the position that the hypnotic state was a histrionic deception; he demonstrated its reality, but unwittingly brought it within range of suggestion or self-deception. Later he realized the error of his earlier work; but his association with phrenology injured his reputation, and delayed the recognition of his pioneer work in a difficult field. The following suggests the course of the experiments:

> I placed a cork endwise over the organ of veneration and bound it in this position by a bandage under the chin. The patient thus hypnotized at once assumed the attitude of adoration, arose from his seat and knelt down as if engaged in prayer. On moving the cork forward, active benevolence was manifested, and on its being pushed back veneration again manifested itself.

This observation seems the very parody of science. It illustrates that prepossession, even in men of shrewd observation and ability, is disastrous to logical integrity; and further that not until the true nature of nervous functioning was established as a fundamental directive position in all psychological considerations, were false leads of this kind entirely discredited.

In view of the fact that the vogue of phrenology in the middle of the nineteenth century represents the largest collective interest in the

study of character that ever gained a temporary foothold, it seems proper to consider the nature of its pretensions and their following. Propagandists have an enviable if perilous vigor and enthusiasm—an element of reckless abandon not unrelated to the extravagances of mania in the exaggeration and self-deception which it entails. Lavater had the simpler problem of collecting drawings and engravings in imposing array to enforce the principles of physiognomy. Gall collected skulls and casts, and induced persons with marked mental peculiarities to have their heads shaven so that their replicas in plaster might be at his service. He asked that

> every kind of genius make me heir of his head. . . . Then indeed (I will answer for it with my own) we should see in ten years a splendid edifice for which at present I only collect materials.

The critical peril of false theories lies in their applications. Gall's interests seem to have remained for the most part scientific and objective; but in association with Spurzheim, whose direction of the phrenological movement largely determined its course, they took a more practical turn, and therein found their degradation. The extension of the phrenological principle to races and animals as a zoological problem appealed to Gall. He tells with ludicrous if pathetic simplicity of his baffling attempt to interpret the prominence of a part of the cranium which monkeys and women have in common. Finally,

> in a favorable disposition of mind, during the delivery of one of my lectures, I was struck with the extreme love that these animals have for their offspring. Impatient of comparing immediately the crania of male animals, in my collection, with all those of females, I requested my class to leave me, and I found, in truth, that the same difference exists between the male and female of all animals, as existed between man and woman.

Thus was the cranial localization of "love of offspring" discovered.

Phrenology similarly offered the clue to racial differences.

> The foreheads of negroes are narrow, and their musical and mathematical talents are in general very limited. The Chinese are fond of colors, and have their eyebrows much vaulted. According to Blumenbach, the heads of the Calmucks are depressed from above, but very large laterally, about the organ which gives the inclination to acquire; and this nation's propensity to steal, etc., is admitted.

It was seriously set forth that the dog, the ape and the ox do not sing because the shape of their heads shows the absence of the faculties for music; that the thrush or the nightingale had heads with developed musical faculties, and the hawk and the owl lacked these parts; that in the male nightingale or mocking bird the head was square, angular, and more prominent above the eyes, while in the female these parts were conical, thus endowing the male and not the female with the gift of song. "Observe the narrow forehead of the dog, the ape, the badger, the horse, in comparison with the square forehead of man, and you will have the solution of the problem why these animals are neither musi-

cians, nor painters, nor mathematicians." Extravagant as this may appear to our scientifically minded generation, it yet represents the more sober conclusions of men conversant with the science of the day. In the hands of system-mongers and quacks the doctrines were carried to far more capricious conclusions.

It was the practical tendency to read character and predict capacity or even career that was responsible for the rapid deterioration of phrenology. This course was set by Spurzheim, under whose influence phrenological societies were founded in England and America, and the world deluged with books, pamphlets, manuals, lessons, exhibitions, charts, plaster-casts, institutes, parlor talks and street demonstrations for the dissemination of character-reading by the bumps of the head—a movement the waves of which still beat feebly along the remote frontiers of intellectual venture. An excursion into these disorderly by-paths—suggestive of the slums of psychology—would have little profit;[4] it would but indicate that slight deviations in principle lead to the widest divergence of result. An intellectual degradation ensues as the movement descends to lower strata,—an issue not unlike the social degradation of sections of cities where questionable occupants inhabit the dwellings that sheltered the respectable citizens of other days. Though we can not hold the founders responsible for this issue, it is yet true that they prepared the way for it by their own practises. Gall and Spurzheim conducted tours in prisons and asylums, reading from the shapes of the heads of the inmates the propensity to forgery, theft, violence or lack of thrift which brought them to their fate. One prisoner showed the "organs of theft, murder, and benevolence all well developed, and, true to his organs, robbed an old woman and had the rope around her neck to strangle her, when his benevolence came to the surface," and prevented the fatality.

Such was the practical degeneration and such the fallacious principles by which phrenology attempted to oust physiology from its domain. At the time psychology was not sufficiently developed to assert its claim against the phrenological pretensions. Spurzheim had a

[4] The excursion would indeed serve to justify the general conclusion that the sporadic survival or revival of such systems as physiognomy, astrology, phrenology, palmistry, fortune-telling, dream-interpretation, etc., is due not to the appeal of their evidence, but to the persistence of the attraction of the occult as well as to the promise of practical revelation. For it is characteristic that this class of latter-day compendium upon "character" through the reading of heads, faces, hands, etc., combines and resurrects with curious ignorance of their source, with a strange insensitiveness to their mutually contradictory positions, all the varied by-paths of obscure and discredited lore which we have cursorily surveyed. Aristotle, Porta, Cardan, Lavater, Gall, Spurzheim reappear in doctrines, without assignment of source, in support of "systems" purporting to reveal the secrets of human nature for the small consideration of the purchase of the volume. The occult—representing poverty if not misery of mind—like misery, makes strange bed-fellows.

stronger psychological bent than Gall, and developed an arbitrary psychology to fit the scheme. He distinguished between the emotional and the intellectual powers, dividing the former into *propensities*, which were direct impulses to action (like the desire to live, the tendency to fall in love, destructiveness) and *sentiments* which were complex human powers (like self-esteem, hope, mirthfulness, ideality); the latter were either *perceptive* (like size, tune, time), or *reflective* (like causality and comparison). This construction was distorted and confused, but yet not so strikingly divergent from other contributions as to arouse suspicion of its forced adjustment to the alleged findings. It was these latter, apparently substantiated by anatomical evidence, that kept the system alive. In the actual procedures of proof the simple psychology of self-deception was the dominant factor. Either the trait was marked and the phrenologist readily persuaded himself that the prominence—at best slight and not clearly defined—was present; or in the presence of a marked "bump," he was readily convinced that the required trait—as a rule a matter of uncertain and variable judgment—was conspicuous. As a contribution to the temptation that allegiance to theory offers to the self-deception in the determination of fact, the retrospective view of the subject has permanent value. Prepossession, though unrecognized by the phrenologists, is likewise a quality of human nature, with an interesting psychology of its own.[5]

At this juncture we turn from the antecedents to the more direct line of descent of modern psychology. The successive claimants to the domain of "character and temperament" may be said to have momentarily triumphed and passed away, without accredited issue. The new sovereignty represents a very different allegiance. It shares

[5] It is characteristic of the wave-like oscillations of movements of this kind that in periods after the desertion of the position by the scientific world, an occasional reaction appears and gains a considerable adherence. An Ethological Society, which publishes the *Ethological Journal*, was founded in 1903 and attempts to reinstate the phrenological position, though in a wholly modified form and with an attempt at reconciliation with the established localization of function in the brain; the latter is in a legitimate sense the new and true phrenology. There is no reason, except the historical one (which, however, is adequate), for giving the term phrenology any less respectable status than that of psychology itself. It is clear that the doctrine of the localization of function in the cortex of the brain represents a chapter in the development of physiology, which replaces the series of conjectural and extravagant views that belong to the antecedents of our subject. It should not be inferred that the Ethological Society is wholly devoted to this reinstatement of phrenology; it considers the entire range of topics bearing upon character and temperament, but presents a leaning towards the impressionistic and obscure interpretations. It may be added that so distinguished a contributor to the principles of modern evolution as Alfred Russel Wallace believed that the neglect of phrenology was one of the intellectual crimes of the nineteenth century, and maintained that this aspect of physiological and psychological research is central in its promise for

in the common heritage of modern science. The notable extension of knowledge through experiment is ever paralleled by a development of logical method and critical interpretation, as well as by an extension of technical resources. To this general movement psychology owes its present status, and shares in its benefits. It finds a concrete expression in the psychological laboratory, and a yet more comprehensive one in the transformation of the entire range of accredited problems, and the introduction of new realms of inquiry. The technical advance in the knowledge and control of physical, biological and psychological forces characterizes the modern world of science. These divisions of intellectual enterprise, though differently directed, are mutually corroborative. They progress by the application of a common logic. *Standards of evidence, extension of data,* and *the basis of interpretation* develop together. Jointly they determine the spirit of modern science, from which psychology along with the rest of the sciences, receives its directive bent and the temper of its pursuit. A coordinate factor is the dominance of an expanding practical philosophy—a worldly wisdom born of a larger experience in social, political and economic relations. It is expressed in the standards of intercourse and living, and more particularly in the cosmopolitan outlook, reflecting the insight into the determination of events and careers as of the qualities of men shaped by, and shaping them. This influence extends to literature, philosophy and the arts of life; it provides the background against which the technical pursuits are projected, from which they emerge.

The establishment of the principles and the body of knowledge determining the present study of character and temperament is the convergent product of a complex development; it forms an integral part of the general advance for which the nineteenth century—the culmination setting in with marked acceleration in the second half thereof —is notable. Our purpose will be served by considering broadly the contributory branches of investigation to which psychology is particularly indebted. Among these the establishment of the relation between body and mind is clearly central. Equally fundamental is the interpretation of the vital processes and provisions through a unifying and illuminating principle. This was supplied by the master-key of evolution, and at once rationalized and vitalized the conception of origins and transformations of natural processes and products—including the manifestations and endowments of the mental nature. Interpretation became possible in a convincing language—quieting the babel of tongues. Both of these guiding principles—the latter particularly—were revolutionary in their influence, not primarily by the new exten-

the regulation of mental affairs in the future. The attempts to restate certain aspects of the phrenological position in modern form should be mentioned. They undertake a "Revival of Phrenology" and are represented by Hollander "The Mental Functions of the Brain" (1901).

sion of knowledge and interest (which was in the main a consequence of the new insight), but by the introduction of a new interpretation. Familiar facts were given a distinctive and a richer meaning. The perspective of significance was notably altered. This momentous reconstruction of the biological realm indicates in a few words the decisive factors that made modern psychology possible. The brevity of the record should not diminish the appreciation of its vital importance.

The development of the knowledge of nervous function has a venerable history. The recognition of sensation and movement in relation to the nerves occurs sporadically and irregularly in Greek, Roman and medieval medicine, at times with a shrewd interpretation of symptoms. It seems never to have been made a leading principle, but was held in detachment from the general notions in terms of which conclusions were stated. Hippocrates, Galen and their followers occasionally record observations in which a limited loss of movement (paralysis) and loss of sensation (anesthesia) were referred to interference with the action of certain nerve-trunks. Such observations remained casual and incidental. The usual explanation of the bodily accompaniments of mental action were given in terms of the flow of the "vital" spirits, with the veins (supposed to contain air) as the true channels of the flow that determined sensation; while the ventricles (literally breathing spaces—actually the channels for the cerebro-spinal fluid) were assigned the central part in the vital service. Vesalius, founder of modern anatomy, knew by experiment apparently as well as through inference from observation, that section of the nerves abolished muscular control and that the loss of the medulla deprived an animal of sensation and movement. He contested the notion that faculties like memory could reside in such spaces as the ventricles of the brain. But such views were heretical to the scriptural authority of Galen and Hippocrates, and were timidly expressed and pursued. As a type of conception matured under philosophical pursuits critically maintained and in relation to the science of the day, may be cited the view of Descartes. He looked upon the nervous system as a mechanical automaton—somewhat after the manner of an elaborate and fantastic "playing" fountain, whose ingenious streams turned windmills and started miniature water-spouts. The nerves were conceived as tubes for the flow of "animal spirits," or of some similar agency, with the pineal gland in the center of the system as a controlling valve directing the flow—the flow according to the course resulting in one kind or another of mental process. Even Willis, despite his insight into the structure and function of the brain and the complex provisions for its circulatory system, could speak of it as an instrument which the "soul inhabits and adorns with its presence." He conceived the blood as a vital flame, through which products of combustion arose and in turn gave rise to mental processes. Each variety of physical change which

the physiologists and chemists discovered in the laboratory of the body —such as distillation and absorption, or fermentation and evaporation, along with the older conception of animal spirits (the latter term used confusedly at once in a psychological and a chemical sense; hence "spirits" of ammonia, turpentine, etc.) were in turn called upon to account for the transformations responsible for the elementary mental processes.

There is nothing notably distinctive in the successive formulations of "nervous" function from the days of Harvey, who gave the directive impetus to physiological conceptions, to those of Haller, who first applied them with marked success to develop the conception of nervous responsiveness (irritability) through specific adaptation of the organism to the stimulus. Haller was not free from the speculative vagaries of his predecessors; yet he thought of the problem of the physiological basis of mental processes consistently and clearly. His contributions so decidedly advanced the conception of nervous function that it was relatively easy to make the transition to the true interpretation given first by a group of physiologists in the early nineteenth century (Marshall Hall, Charles Bell, Majendi) and culminating in the actual measurement of the rate of nervous impulse by Helmholtz in 1850. The position of Haller is notable not only for the general correctness of his conclusions and the experimental evidence upon which they were based, but equally because he separated so clearly what was conjectural from what was established. In a number of cases the task of his successors was merely to follow his lead and transform conjecture into proof.[6]

[6] An admirable statement of the development of knowledge of the nervous system is found in Sir Michael Foster's "Lectures on the History of Physiology" (1901), Chapter X. G. Stanley Hall's "History of Reflex Action" (*American Journal of Psychology*, January, 1896) should also be consulted. Andrew D. White's "History of the Warfare of Science and Theology" (1896) provides an illuminating commentary upon the movement of thought through which the present subject reached its modern stage. Of the histories of psychology that of Dessoir (1912) contains the most distinctive appreciation of the "character and temperament" movement. Of the more recent studies the most noteworthy are: A. Levy, "Psychologie du Caractère" (1896); Malapert, "Temperament et Caractère" (1902), "Les elements du Caractère" (1906); Alfred Fouillé, "Temperament et Caractère, etc."; Paulhan, "Les Caractères" (1894); Th. Ribery, "Essai de Classification Naturel des Caractères" (1902); L. Klages, "Prinzipien der Characterologie" (1911); Sternberg, "Characterologie als Wissenschaft" (1907); C. J. Whitby, "The Logic of Human Character." These works are by no means of comparable value, scope or treatment; nor does any one of them interpret accurately the message of modern psychology upon the subject. The literature bearing upon the training of character is large, but not pertinent to the present survey. Of books of other purpose with important bearing upon the subject may be mentioned MacDougall, "Social Psychology" (1908) and Wallas, "The Great Society" (1914). A peculiarly notable volume is A. F. Shand, "The Foundations of Character" (1914). No reference is made in the retrospective view or in the recent literature to the several modern attempts to

This account of one strand in the network of data indispensable to the establishment of a psychological point of view is presumably typical of parallel movements. It indicates how recent are the steps of direct bearing upon present-day problems, and in so far justifies the slight consideration (in the present connection) of the remoter and more fragmentary historical antecedents. It will also make it easy to understand how readily in the absence of an accredited and established view of the bodily correlates of mental action, the ambitious innovations as well as the traditional survivals of beliefs could gain a foothold. This is true in part of even so late a propagandum as that of Lavater—which in large measure was operative before the day of the most decisive discoveries—and to the careers of Gall and Spurzheim, whose contributions in part came after them. The spirit of nineteenth-century science was not then sufficiently disseminated to make obvious the irrelevancy of such pretensions as phrenology, nor indeed to offer a satisfactory consideration of the problems which that system professed to solve.

In the collateral ancestry of "character and temperament" the anthropological attitude occupies an important place,—in a new sense making mankind the proper study of man. It forms part of the broadening outlook upon the constitution of nature in general and human nature in particular, that characterizes modern thinking. It doubtless has a relation to the closer study of the political struggles of nations and to economic expansion, though the relation is not intimate. It aimed at a philosophical interpretation of the structure and motive sources of human society and institutions. The anthropological interest extended to the characteristics of the social groups, particularly of races and peoples in different stages of development and under the sway of distinctive cultures. The enlargement of outlook resulted from the spirit of exploration and inquiry, which brought knowledge of peoples and habitations and other systems of culture, and in another direction extended the reconstruction of the past of man. A similar enterprise resurveyed the story of the intellectual past and traced the slow control of the forces of nature through invention, and the equally laborious attainment of a social control through the organizations of men. The larger intercourse with varieties of mankind together with the broader interpretation of the forces responsible for the development resulting from the same spirit of exploration and inquiry that led to the technical scientific advances, brought with it a more thorough knowledge of the diversity of men and civilizations, and traced in the latter

develop "readings of character" from signs and systems of appearance or expression. The best-known of these is palmistry and graphology. That handwriting has a modest place as an expression of the neuro-muscular function is an admission that in no sense qualifies it to serve as an index to "Character." That a few students of handwriting have appreciated the physiological and psychological aspects of their findings is to be recorded.

the issues of the interplay of desires, capacities and beliefs, by which to interpret our own and (with allowance) foreign natures. Culture acquired a more real and a richer meaning as a psychological product, and therewith conferred a new insight and a new obligation upon the psychologist. The diversity of men was thus related to their divergent solutions of the problem of shaping their lives to satisfy needs, impulses and desires; and the environment, so largely a psychological one, acquired its full significance. The study of human nature embraced more than that of one time and region and status. The still more recent and independent emphasis of the sociological aspects of life is in the larger view an issue of the anthropological interpretation, but is yet more characteristic of the attitude now dominant, and properly called modern. The psychology of the social relations was thereby made an integral part of the study of human character.

Two further aspects of the qualities of which character and temperament form the realistic composite, are the genetic aspect, and the abnormal—the pathological aspect. The growth of traits is an essential part of their nature. It implies a reference to the setting in which they operate, to which they are adapted, by which they have been shaped. It implies equally the reference to the vital course, the maturing unfoldment of native endowment, which makes the biological aspect of human nature the most comprehensive and the most elemental. Within this compass the determination of hereditary forces and their mode of operation assumes a special importance. The traits forming the composite of Character and Temperament are part of the biological inheritance, are the issues of forces whose fundamental significance is the biological one. Accordingly (despite or in addition to our more detailed interests in other aspects) they must reflect and conserve the allegiance to this underlying relation. More specifically, the genetic aspect differentiates the outlines of the stages of growth; in its terms are described the orbit of the psychological cycle. It yields the psychology of infancy, of adolescence, of maturity, of senescence, and presents the course of the included qualities in mutual illumination. The genetic argument emphasizes a progressive environment and a progressive purpose; it enlarges the scope of adaptation, and it interprets the impetus and goal of varying interests and endeavors. It was never absent from the accredited psychology of human nature, but in the modern view it assumes an explicitness and a directive position that constitutes it a notable factor among the available resources. It has powerfully affected our entire view of human qualities, has extended our data and enriched their interpretation.

A parallel statement may be made of the argument from the decay, the faulty development, the inherent liability to perversion, of natural qualities, which are responsible for the pathological, the abnormal, the divergent aspects thereof. Useful adaptation, due proportion, tem-

pered blending, related emphasis of traits stand as the normal issue; the divergence or failure thereof becomes the abnormal. The abnormal in excess or defect takes its place as an instrument of analysis and an enlargement of data. It is a distinctively modern resource, particularly in the refinement of its application.

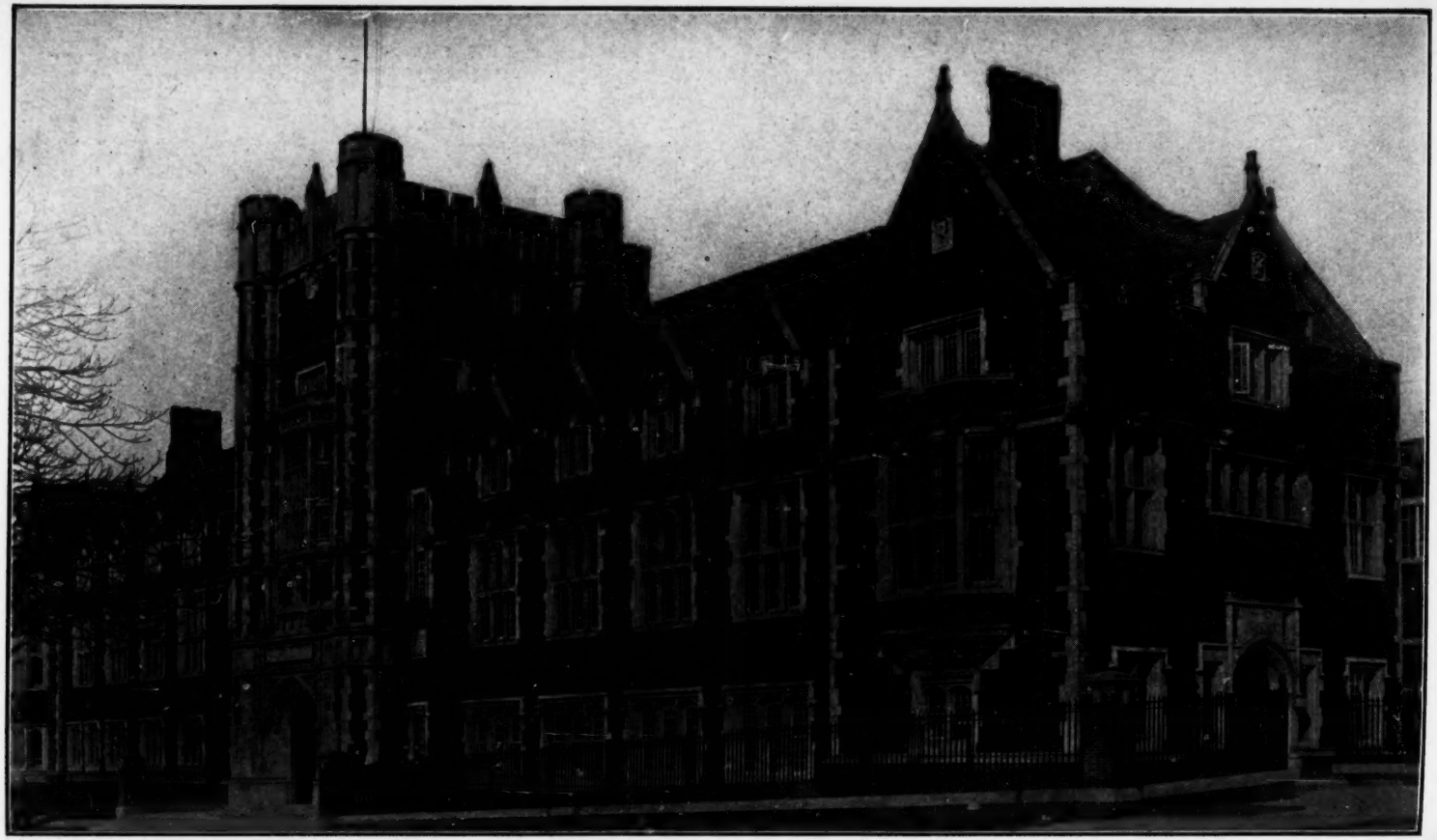
It is in such general terms that the line of descent of the present psychological interpretation of human endowment proceeds. The more specific history of the attempts to formulate the resultant positions is brief. The classic chapter (Book VII., Chapter V.) "Of Ethology, or the Science of the Formation of Character," in John Stuart Mill's "System of Logic" (1843), though a programme rather than a contribution, still has significance. The project was undertaken by Alexander Bain in a volume bearing the title "On the Study of Character" (1861). Though Bain wrote at a time when psychology had made rapid advances and the vagaries of phrenology had been retired to their proper place, he devoted a considerable portion of his book to a refutation of the phrenological position. He thus conferred an undeserved dignity upon these findings and gave his constructive views an unfortunate setting. The subject was independently pursued by a group of writers (mainly in France and Italy), whose contributions in part belong to the living literature of the subject.[7]

It remains to touch upon the collateral streams of interest which in modern times maintained the study in one or another aspect, thus bridging the gap between the old and the new learning. Among these is the attempt, never wholly absent in practical ages, to guide training, to indicate on the basis of an analysis of character the promise of youth, and the direction of vocation—all in the spirit of a worldly wisdom. As an example of the earlier period, the work of the Spaniard, Huarte (1530–1592) "The Trial of Wits," may be cited, since it seems to have attained a large circulation, was translated into several languages (the English edition appearing in 1698), and the German so late as 1752 by the great Lessing (1729–1781). There were other writings of similar import both before and after Huarte. It is, however, difficult to estimate their influence in the current of thought destined to be redirected in a more scientific analytic interest. There is no hesitation, however, in recognizing in the works of Kant (1724–1804) a dominant influence in the rehabilitation of the subject. This appears not alone in his recognition of the claims of the practical reason, but notably in his "Anthropology" (1798). Indeed Kant's use of this term corresponds more closely to a study of the individual differences of men—which the problems of character and temperament consider—than to the content of the science which now bears that name. Special attention should also be directed to his "Observations on the Sense of the Beautiful and Sublime," in which is given in a modern vein a detailed

[7] See previous note.

analysis in the field of the emotions, with excursions into the comparative psychology of the sexes and of nations. It shows the shrewd analyst in an engaging light. Of the writers affected by the Kantian position, who realized that the study of character offered a great field for the applications at once of philosophy, of anthropology and of education, Julius Bahnsen is the most representative. His work on "Charakterologie". (1867) both in method and scope represents the attempt to reach general and practical conclusions in the spirit of the early nineteenth century. It does not incorporate the views of the bases or sources of character which were even then available and which were represented by a group of German physiologists, such as Johannes Müller (1801–1858), K. F. Burdach (1776–1847) (and in a different temper Lotze and K. G. Carus)—who as sympathetic with the life of the practitioner brought to their philosophical generalizations the spirit of exact knowledge.

The establishment of modern psychology is the culmination of many interests; in no aspect is this historical development more significant than in regard to the sources of the view of the qualities of men as applied in modern life. The attempt to short-circuit the route from theory to practise, from understanding to application, has always ended disastrously. The correctness of the foundations determines the strength of the edifice. The study of the nervous system and the recognition of the subjection of all human traits to an evolutionary process laid the foundations. The sociological expressions of human qualities were related to their biological significance. The competition of human qualities received a psychological interpretation. Narrow views were avoided by considering the varieties of human culture and expression. Institutions, though dominantly an environmental product, became significant as embodiments of psychological needs and their satisfaction. Vocations became directions of special endowments. National characteristics were similarly interpreted. Education was seen to be a transformation of original trends as well as a direct preparation for the situations of an artificial life. Human nature was at once the material upon which all desired ends had to build, while yet to be remodeled for such cherished purposes. A closer knowledge of the mode of working of the human endowment resulted from the experimental study of the underlying processes of the mind. Language, art, science, customs, social institutions, political relations, reflected the spirit of a collective mind, though often articulate through the original contributions of favored individuals. With this combined equipment the psychologist of to-day proceeds to the interpretation of the traits of men summarized in the study of character and temperament. The antecedents of this view form a notable chapter in the development of the human mind, in the story of the control of the psychic forces of which culture is a record.



THE THOMAS W. EVANS MUSEUM AND DENTAL INSTITUTE.

THE PROGRESS OF SCIENCE

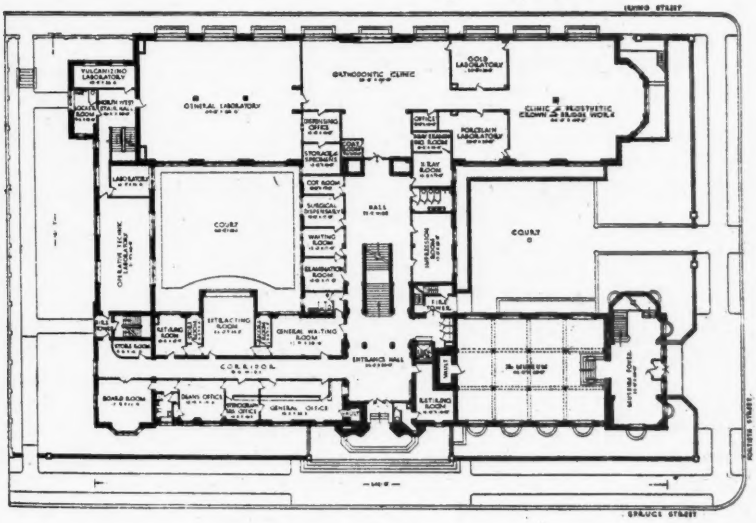
THE THOMAS W. EVANS MUSEUM AND DENTAL INSTITUTE

THE recent dedication of the Evans Dental Institute School of Dentistry, University of Pennsylvania, marks an epoch in the history of dental education as it formally opens the largest and best equipped plant in the world, devoted exclusively to the teaching of dental science. The standard which the Evans Institute will be able to maintain will be of the very highest type, and will result in carrying out, in the most effective manner possible, the wishes of the Philadelphia philanthropist, by whose name the institute and school will hereafter be known.

The new building is in the Tudor style of architecture which prevailed in the time of Henry VIII. and might be described as collegiate gothic, being in keeping with other late buildings, constructed of Indiana limestone and hard-burnt brick. It was designed by John T. Windrim. Ground was broken on September 24, 1912, and the corner-stone was laid on May 3, 1913. The building has a frontage on Spruce Street of 242 feet, and a depth to Irving Street along Fortieth Street of 161 feet. It is built in the form of the letter H and has three stories over a high basement. The benefaction of Dr. Evans includes this building with its equipment and a substantial endowment fund.

Among the interesting features of the building are the square tower and the Evans Museum. The tower, which is at the main entrance at the center of the Spruce Street wing, is thirty-eight feet square, rising to eighty-four feet. In the center of the tower, beginning at the second story and reaching almost to the top of the third floor, is a large window, which lights the library on the second floor.

The Evans Museum occupies the east half of the Spruce Street wing, and is as nearly fire and burglar proof as modern science can make it. This houses the priceless Evans collection.



PLAN OF THE FIRST FLOOR.

THE OPERATIVE CLINIC HALL.

In the west end of the Spruce Street wing are the offices of the dean of the institution, and the board-room. The rest of the ground floor is divided into class-rooms and laboratories, the entire north wing being devoted to this purpose. To the right and left of the monumental hallway, which extends from the roof to the first floor, are rooms for various phases of clinical dental service, radiography, photography, instructors' rooms, etc., and a model dental office.

Another of the imposing features of the building is the large operative clinic hall in the north wing on the second floor. This occupies th entire wing on Irving Street and is two hundred feet long by forty-eight feet wide. This clinic room is thirty feet high, with a glass wall on the north side; the roof for a distance of about ten feet is also glass, giving all the daylight possible. The floor is covered with battleship linoleum. A gallery on the south side contains the lockers. The room is fur nished with 135 chairs, each chair equipped with electric service for power and light. There is also gas, compressed air and water service to each chair.

In the south wing, on the second floor, is the library, which extends up through the third floor, with galleries on each side. From the library, on the east end, extends the main lecture hall, eighty-seven by forty-three feet, and on the west end are two smaller lecture rooms. One of the principal objects of the institute will be the encouragement of research work, and a number of rooms for that purpose are on the second floor.

The main stairway ends at the second floor, in a large hall open to the roof. The side walls of this hallway are in pinkish gray stone, and the ceiling is of metal and plaster, formed and painted to represent the carved wooden ceilings of the Tudor period. Large laboratories, with lighting similar to that in the clinic, occupy the south wing on the third floor, and other rooms for research work and post-graduate instruction in the western end. In the basement are locker rooms for the students, laboratories for mechanical dentistry, the metallurgical laboratories, and laboratories and lecture rooms for first-year men, and a restaurant for students and faculty. The power house adjoins the building on the north. This contains two boilers with a capacity of 400 horse power. The engines and electric generators are capable of producing 240 kilowatts, and will furnish power for the lighting and heating, as well as for the laboratories and the chairs in the clinic.

The School of Dentistry at the university was organized in 1878, being the third dental school in America to be connected with a university. The dental school is the most cosmopolitan of the departments of the university, its students usually representing about twenty-five foreign countries and almost every state of the union. It now has a teaching staff of eighty-three professors and instructors, and six hundred and sixty-five students. The school operates a free dispensary, in which about 40,000 cases are treated annually.

When the school was first organized, it occupied for a short time a room in the old Medical Hall (now Logan Hall), and subsequently quarters in the Hare Laboratory of Chemistry at Thirty-sixth and Spruce Streets, but in 1896 it removed to a building especially constructed for it. There its growth has been remarkable, and it has long since outgrown its "new" quarters. It now enters into its fourth home, The Thomas W. Evans Dental Institute.

By concurrent action of the trustees of The Thomas W. Evans Museum and Institute Society and the University of Pennsylvania an agreement between them was executed in 1912, by the provisions of which a cooperative affiliation of the two institutions was consummated so that the resources of both have been utilized in the creation of a dental school to be carried on "as such institutions of learning are now conducted in Philadelphia, and not inferior to any already established," as provided for in the will of the late Dr. Thomas W. Evans, an eminent scientific man and dentist who practised in Europe, but who was born in Philadelphia, and lived in a house which stood where the building bearing his name now stands, which houses the affiliated institutions, at the northwest corner of Fortieth and Spruce Streets.

LOCOMOTIVES AND STEAM ENGINES IN THE NATIONAL MUSEUM

PROBABLY no museum collection better illustrates the development of the steam engine, particularly the locomotive, than the exhibit of the U. S. National Museum. It possesses a model of a very early machine designed by Sir Isaac Newton in 1680, which was propelled by a jet of steam projected backward against the air, and a model of Denis Papin's invention of about the same time. The investigations of Savery, and Papin, and the successful experimental engines of Thomas Newcomen in 1705, with his piston and cylinder soon followed. Newcomen's ideas were improved by James Watt in 1769, who also introduced the high-pressure

engines, the condenser, and later the double-acting engine. The development of the engine was advanced by Cugnot, Evans, Hornblower and Murdoch; a model of the latter's engine is on display in the museum.

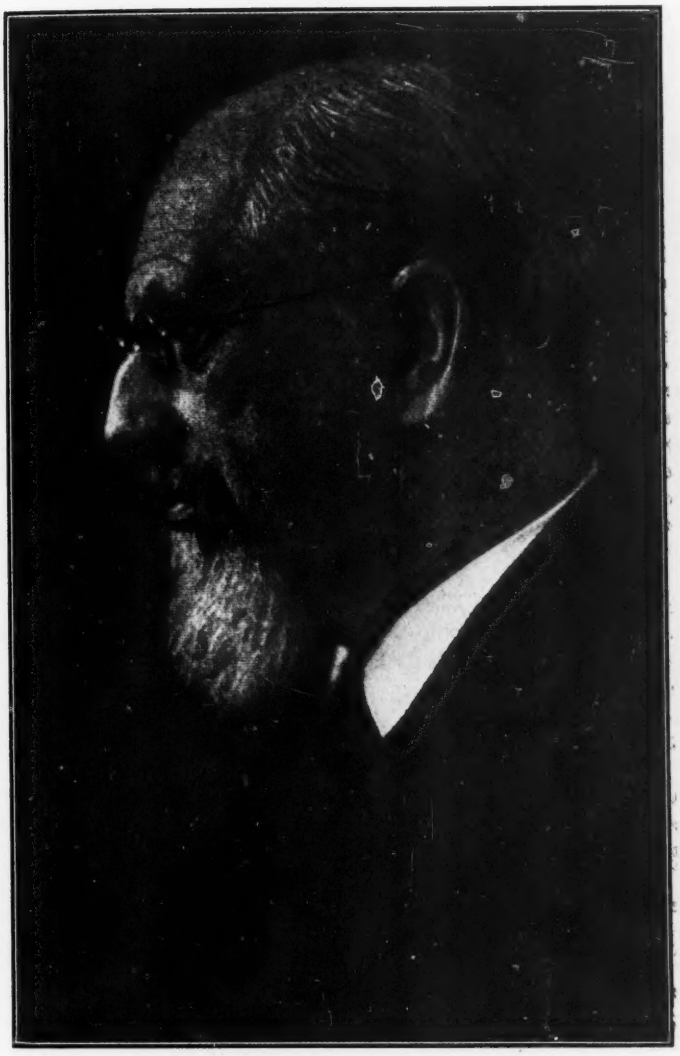
Richard Trevithick made the first engine to run on rails in 1803. It has been claimed that he copied the stationary engine built in 1800 by Oliver Evans, an American, which was later attached with wheels to a scow and propelled it by steam through the streets of Philadelphia in 1804. This curious creation called the "Oruktor Amphibolis," was the first motor car to run on American soil.

A model of Trevithick's engine is to be seen in the National Museum, as is also the model of the engine employed by John Stevens in 1825, and his original tubular boiler. Other models illustrate nearly all the types which began to put in their appearance soon after 1828, when the "Stourbridge Lion" was built in England and shipped to America, where it was the first engine to run on full-sized rails. The museum possesses not only the model of this historic engine, but the original engine itself. The other original full-sized locomotive to be seen in the museum, is the "John Bull," built by George Stephenson and Sons, of England, and shipped to America for use in 1831 on the Camden and Amboy Railroad. This old relic of early railroading in America made a round trip under its own steam in 1893 from New York to Chicago, where it was exhibited at the Worlds Columbian Exposition. Among the models of early and historic locomotives are: George Stephenson's "Rocket" built in 1829; The B. & O. engine "Tom Thumb," built by Peter Cooper in 1829; the grasshopper type engine, "Arabian" of 1831; the "Best Friend" used in 1830–31; Baldwin's "Old Ironsides" constructed in 1832; the "Sandusky" built in 1837, and models of engines made by Asa Whitney, in 1840, and G. A. Nicholls in 1848. Besides the two locomotives and the numerous engine models, there are in the exhibit, coach and car models, sections of rails, spikes, wheels and models and parts of valves, pistons and other early patented accessories pertaining to locomotives and railroads, all of which go far toward completing an absorbing chapter of graphic history in connection with this interesting and important commercial development.

THE IMPROVEMENT OF ACOUSTICAL CONDITIONS

At Western Reserve University the ceiling and walls of the Amasa Stone Memorial Chapel have been treated for the purpose of perfecting the acoustics of the building. The chapel is one of the most beautiful Gothic churches designed by Henry Vaughan, of Boston. Unfortunately, however, as in many lofty structures, the acoustics have not been satisfactory. A series of experiments with sounding boards was made by Professor Frank P. Whitman, of the department of physics of the university, in the hope of improving conditions. Careful data obtained by Professor Whitman showed that the effect of the sounding boards was almost negligible. Acoustical experts were called upon to study the problem.

The difficulty experienced in the auditorium was found to be what is technically known as reverberation, in excessive amount. Owing to the size of the building and the consequent long distance between reflections of the sound from one surface to another, and also owing to the hard and unyielding building materials which cause only a small percentage of the sound to be absorbed at each reflection, the result was that every sound generated within the chapel persisted for a number of seconds after the source itself had ceased, thus causing great blurring and confusion in spoken addresses, owing to the overlapping of the sounds of consecutive syllables. This phenomenon has been the subject of extensive study by Professor W. C. Sabine, of Harvard



WILLIAM HEALEY DALL,

whose fifty years of service to science was commemorated by a banquet at Washington on April 21, when distinguished speakers gave appreciations of Dr. Dall, the Alaska pioneer, the anthropologist, the coast pilot, the malacologist, the paleontologist, the zoologist, the nomenclatorist, the poet and the man.

University, who has established the laws governing it in a series of researches conducted during the past fifteen years.

The correction of the chapel was engineered by Mr. C. M. Swan, acoustical expert of New York City, and associated with Professor Sabine. Layers of highly sound-absorptive felt were placed on a portion of the interior surfaces of the chapel, the thickness, area and location being governed by the requirements of the problem. The careful consideration of these factors is said to be essential to a successful outcome to the work, as accurate figuring must be done to produce a mean condition satisfactory both for music and speaking. An over-doing of the treatment would produce a "dead" condition and a diminution of the loudness of the sound, which would prove as objectionable in its way as the original condition of general reverberation.

The treatment was installed by a local firm of contractors under Mr. Swan's direction, and was covered with a protective and concealing membrane in such a way that the untrained eye would not perceive the change. Even the most unskilled ear, however, is quick to perceive the change which has been brought about in favor of normal conditions of hearing. It is said that the improvement in the acoustics has been remarkable and that a degree of comfort is now experienced in the use of the chapel which has never before been possible.

SCIENTIFIC ITEMS

WE record with regret the deaths of Dr. Jay W. Seaver, for twenty-five years director of the Yale gymnasium and professor of hygiene in the university; of William Harlow Reed, curator of the museum and instructor of geology in the University of Wyoming; of Mr. Richard Lydekker, F.R.S., known for his work and writings on natural science; of Dr. Arthur Sheriden Lea, formerly university lecturer at Cambridge on physiological chemistry, and of Professor Friedrich Loeffler, the distinguished pathologist, who in 1884 discovered the diphtheria bacillus.

MEMBERS of the National Academy of Sciences have been elected as follows: Dr. Charles Greeley Abbot, director of the astrophysical laboratory of the Smithsonian Institution; Dr. W. E. Castle, professor of zoology, Harvard University; Dr. G. Stanley Hall, president of Clark University and professor of psychology; Dr. Frank R. Lillie, professor of embryology, University of Chicago; Dr. Graham Lusk, professor of physiology, Cornell Medical School; Dr. Robert A. Millikan, professor of physics, University of Chicago; Dr. Alexander Smith, professor of chemistry, Columbia University; Dr. Victor C. Vaughan, professor of hygiene and physiological chemistry, University of Michigan; Dr. H. S. White, professor of mathematics, Vassar College; Dr. S. W. Williston, professor of paleontology, University of Chicago.

MR. ANDREW CARNEGIE'S gifts to the Carnegie Institute and Institute of Technology have now reached a total of $27,000,000, his latest contribution announced at Founder's Day, on April 29, being $2,700,000. Of this latter amount $1,200,000 is for new buildings and $1,500,000 for endowment.—The campaign to raise $1,385,000 for the Stevens Institute of Technology in Hoboken, N. J., has been successfully concluded. The entire indebtedness of the college, amounting to $385,000 has been cancelled, leaving $1,000,000 to be used for the erection of new buildings and for endowment.

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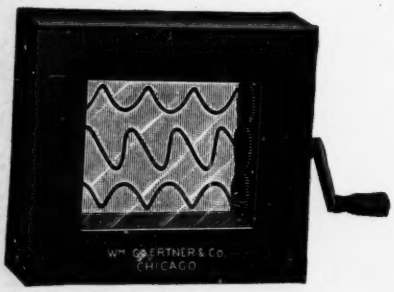

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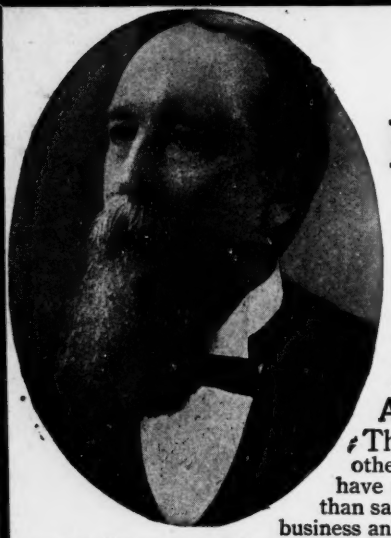

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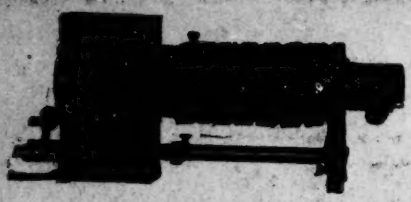

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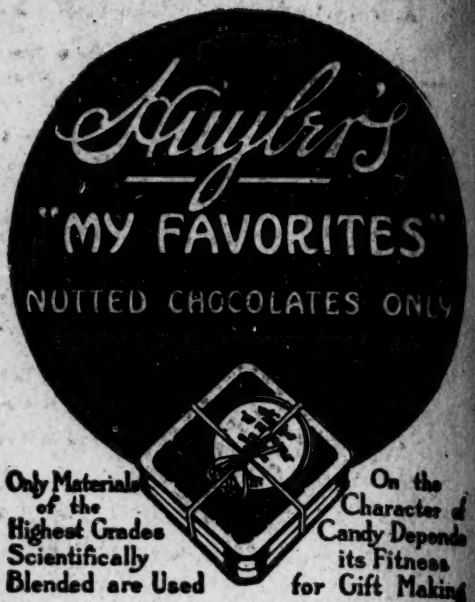

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